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IMPERIAL BUREAU OF ANIMAL HEALTH

THE

VETERINARY BULLETIN

TRICHOMONIASIS—A REVIEW OF RECENT LITERATURE

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A.—TRICHOMONIASIS IN CATTLE

1. INTRODUCTION

The association of *Trichomonas foetus* with diseases of the reproductive system of cattle has long been recognized in certain parts of Europe. This parasite is now known to exist in many countries, including Great Britain and Northern Ireland, Germany, Denmark, Holland, France, Austria, Italy, Switzerland, Rumania, Yugoslavia, Poland, Czechoslovakia, Hungary, South Africa, the United States of America, and Japan. The possibility of its occurrence in other countries should not be overlooked.

2. PATHOGENICITY AND ECONOMIC LOSS

T. foetus is associated primarily with disease of the genital organs, but trichomonads have been found in the bloodstream of cattle by Küst (1936) and Sälzer (1938). Wagner and Hees (1937) isolated the organisms from the blood of 62·5% of bulls, 75·2% of cows, 50% of mares, and of a pig, a dog, and cats examined. Madsen (1941) found *T. foetus* in the heart blood, besides the mouth, stomach, and lungs of an aborted bovine foetus and suggested that this might indicate the possibility of congenital transmission of infection; invasion of the bloodstream from the digestive tract may, however, have occurred after death since the foetus was not examined until 12 hours after abortion. The presence of trichomonads in the bloodstream was not confirmed by Swangard (1938 and 1939), Kerr and Lamont (1938), Kerr and Robertson (1941), Abelein (1941*b*), nor Kerr (1942–43). Kerr has suggested that these bloodstream organisms are not trichomonads, but may be entirely different parasites (probably *Trypanosoma theileri*), not in any way associated with trichomoniasis of the genital tract.

The incidence of, and the extent of the economic loss due to trichomoniasis have been carefully studied during recent years. Rees (1938 *a* and *b*) investigated the disease in a dairy herd of 300 animals, including 20 bulls, over a period of about 18 months. During this time an average of 125 females of breeding age were examined seven times, and trichomonads were demonstrated in ten (8%) of them. The average annual calf crop from the infected heifers and cows was 0·1 calf per animal, and from the non-infected animals the average was 0·7 calf per animal. Of the 20 bulls, 6 (30%) were infected and each infected bull sired some living calves. In Yugoslavia, Pavšič (1938) examined 117 cows with various reproductive disorders, and demonstrated *T. foetus* in an aborted foetus and in 20 of the cows, *viz*, in 6 of 52 with vaginitis, in 3 of 32 with endometritis, and in 11 of 22 with pyometra. Andrews and Miller (1938*a*) investigated the disease in a herd of 40 heifers and, using a method developed and described by them, found trichomonads in the vagina of 34 for periods of 7–40 weeks. From these 40 heifers, four calves were aborted, two were stillborn, and one was lost "apparently by pyometra". Seven heifers were slaughtered after an average period of 62 weeks following their first service, because they showed no signs of pregnancy after repeated service; one of these, however, was found P.M. to be pregnant. Twenty-six of the heifers produced normal calves, but collectively the time required to produce these calves amounted to 480 weeks more than the normal time. Schoop (1940) investigated the disease in 14 *Kreisen* in

the neighbourhood of Kurhessen, Germany, where he found infection in 46 localities. The average number of breeding animals in each locality was 200, of which about 80 aborted or were sterile each year. The loss of milk per infected animal was estimated to be 1,000 litres. Thus, in a locality in which 80 animals were infected, the resultant loss would be 80,000 litres of milk, and in the whole 14 *Kreisen* it would amount to about 3,680,000 litres each year. There was also an additional loss of about 3,680 calves per year. Over a period of eight years, Madsen and Jensen (1940) found that 506½ of an expected 2,400 months of production were lost from temporarily and permanently sterile heifers in the Utah Experiment Station dairy herd, which comprised 30 milch cows and about 30 heifers. The cows lost 293½ of an expected 2,400 months of production, the economic loss of which was partially overcome by extended lactation periods. There was evidence to confirm the fact that, to a certain extent, the disease is self-limiting, because among 18 cases of infection occurring in females over a three-year period, with two cases in bulls, there were complete recoveries in ten of the females.

In Iowa, U.S.A., McNutt, Blohm, and Barger (1939) examined 637 animals after slaughter and found trichomonads in only four heifers, which all came from the same farm. From this observation and the examination of herds over a period of six years, they concluded that the incidence of trichomoniasis was low in Iowa, since probably less than 0·5% of herds were infected. Morgan (1941) examined 560 bovine uteri at a packing plant in Wisconsin and found that 416 were pregnant and normal, 110 were non-pregnant and normal, 31 were non-pregnant and had pyometra, and three were pregnant and had pyometra. Of the total number of uteri examined, eight (1·4%) were positive for trichomonads; five of these were non-pregnant uteri and had pyometra, and two were pregnant and had pyometra. The remaining uterus contained an apparently healthy seven-month-old foetus, the amniotic fluid of which was teeming with trichomonads. Amongst an additional 1,577 uteri examined in Wisconsin by Morgan and Wisnicky (1942), 997 were pregnant and 580 were non-pregnant. *T. foetus* was found in two of the pregnant group and in 13 cases of pyometra in the non-pregnant group, *i.e.*, 0·95% of these slaughtered cows were infected. No trichomonads were found in 211 bulls examined at the same abattoir.

With regard to the disease in bulls, the examination by Andrews and Miller (1938*b*) of some of the sires in the herd already mentioned (Andrews and Miller—1938*a*), and of other bulls, produced evidence that the organisms occurred solely on the glans penis and prepuce, a result which, in general, confirmed the findings of other investigators concerning the predilection site of the parasite in the male. The observations of Rees (1938*a*), Swangard (1938), and Abelein (1941*b*) also agreed with this result, Abelein also having failed to find evidence of invasion of the blood, semen, or urinary system by *T. foetus*. On the other hand, Kerr (1942–43) demonstrated *T. foetus* in the urethral tract in two bulls, and in the preputial sheath and epididymis of one of them which developed an acute orchitis five months after infection. Many authors have described symptoms exhibited by infected bulls, especially the presence of a mucopurulent discharge from the prepuce and of small reddish nodules on the mucosa of the penis. In infected bulls from two herds which he examined, Gould (1939) did not observe any clinical symptoms, although there was an invariable history of infertility. He mentioned that the mucous membrane of the penis appeared normal, and considered that the bull served mainly as a mechanical carrier of infection while the infertility appeared to be due to the cows, as each infected bull usually proved to be fertile when mated with "clean" heifers, although early abortion followed, at 8–12 weeks. Karlson and Boyd (1941) reported a case of orchitis and seminal vesiculitis in a five-year-old bull. *T. foetus* and *Corynebacterium pyogenes* were isolated from the lesions, which were not typical of *T. foetus* infection, but resembled those usually produced by *Corynebact. pyogenes*. It was suggested that *T. foetus* was the primary invader and that the changes in the tissues favoured secondary bacterial invasion. A comprehensive account of the symptoms of *T. foetus* infection and those of secondary bacterial invaders has recently been published by Kerr (1942–43).

3. Experimental Infection

Attempts to determine whether or not *T. foetus* is pathogenic have been made by means of experimental inoculation. Rees (1937*b*) inoculated intravaginally in August four virgin heifers with a bacteria-free strain of *T. foetus*. Two uninfected control heifers conceived at the first service and each delivered a healthy calf. One of the four infected animals was killed "because she appeared to be anoestrous"; the other three heifers retained trichomonads for 60–90 days after inoculation. They came into oestrus irregularly and at each period were served by uninfected bulls. In March of the following year, only one heifer was pregnant and in May the other two showed signs of pregnancy, but in October none had calved. Three other heifers, served by an infected bull, became infected after an average incubation period of 12 days.

Beller and Schaaf (1939) infected 17 cows and one bull by intravaginal or intrapreputial inoculation of pure cultures of genital trichomonads. Intravenous inoculation failed to transmit infection. Trichomonads were found by microscopical or by cultural methods for varying periods up to ten months in vaginal or uterine mucus and they were rarely or infrequently found after a year in the infected bull. Infection resulted in abortion in two cases, pyometra in two cases, and sterility, often with anoestrus, in eight cases. In three cows in which trichomonads were demonstrated, pregnancy was normal. Beller and Schaaf considered that the manifestation of symptoms was not dependent upon simultaneous infection with a bacterium or a virus, but that the variation in clinical response was associated with constitutional or environmental conditions.

Garlick (1939) infected two three-year-old cows by artificial insemination. The first cow, which had previously borne a normal calf, received semen from an infected bull, but, as conception did not occur, two further injections were made. The cow did not become pregnant and 6½ months after the first attempt at insemination it was slaughtered, when the uterus and ovaries were found to be, apparently, normal. *T. foetus* was, however, cultivated from the vagina but not from the uterus. The second cow, which had delivered two normal calves, received semen from the same bull and *T. foetus* was recovered from her 15 days after insemination.

Although Abelein (1941*b*) could find no evidence of the occurrence of trichomonads in the semen or vasa deferentia, Kerr (1942–43) isolated them from the testes, and it is reasonable to suppose that they could easily contaminate the semen during its collection. In view of the increasing practice of artificial insemination, the possibility of the transmission of trichomoniasis in this manner deserves serious consideration.

Rees (1938*c*) and Rees and Garlick (1939) infected 15 cows and heifers by intravaginal inoculation of pure

cultures of *T. foetus* and by allowing service with an infected bull. Five of these animals had already been affected with trichomoniasis and the remaining ten were "clean". In most cases, the first infection was severe whilst reinfection was mild. One heifer infected during pregnancy showed no ill effects; another showed no evidence of oestrus; in seven cases, infection resulted in failure of early conception and in irregular oestrus or temporary anoestrus, but infection finally disappeared and normal pregnancy followed; in one heifer conception was followed by pyometra; one cow, which had had a vaginal infection as a heifer, showed slight resistance to infection, whilst four cows, reinfected and then served by an infected bull, showed marked resistance. When the animals were artificially infected by the intravaginal route, the incubation period appeared to be only two days, but by coital infection the average period was 11 days, although the method of transmission did not appear to have any effect on the course of the disease. Trichomoniasis developed in every female served by an infected bull. The cows were repeatedly examined and *T. foetus* was found at 58% of all vaginal examinations. Infection which persisted in a bull for 20 months had no apparent effect on potency. Rees and Garlick consider the bull to be the most serious source of trichomoniasis because (1) the infection appears to be permanent, (2) transmission can occur at every service, and (3) even semen from an infected bull used for artificial insemination may transmit the infection.

Beller, Schaaf, and Scherle (1938) infected a 16-month-old bull by a series of intrapreputial injections of a pure culture of trichomonads and by service of an infected cow. The bull later transmitted the infection, but demonstration of organisms in the bull was very difficult. They suggested that the only reliable diagnostic method for bulls was to allow them to serve uninfected cows, which could then be examined after they had had time to develop infection.

Abelein (1941*a*) had eight heifers served by bulls which had not previously been used for service, and then injected them intravaginally with a pure culture of *T. foetus* with the following results:– two heifers aborted at 4–6 weeks, and two others within three months; two developed endometritis; one became sterile, and only one calved normally. In an attempt to show that trichomonad infection can be established in bulls without the agency of secondary factors such as a virus or preputial catarrh, nine young bulls which had not served any cows were inoculated intrapreputially with pure cultures of trichomonads which had been passaged a number of times in the hope of freeing them from any virus which might originally have been present. Six bulls remained healthy, but, in the other three, trichomonads were present for six weeks, four months, and over six months respectively. Abelein suggested that trichomonads may be able to maintain a parasitic existence in other animals or lead a saprophytic existence and thus account for the reinfection of clean herds. He also considered the possibility of the organism's becoming encysted and being able to survive outside the body for long periods of time, but did not give any evidence in support of these speculations.

Schoop and Oehlkers (1939) observed in their cultures of bovine trichomonads, rounded individuals which they suggested might be encysted forms. On the other hand, Pereira and de Almeida (1940) did not believe that cyst formation occurred, considering the amoeboid forms which they described from cultures of *T. vitali*, *T. muris*, *T. caviae*, and *T. hominis* neither to be related to the so-called "cysts" of various authors, nor to be degenerating forms.

Hees (1938) reported upon an increased incidence of vaginal trichomoniasis in women in Wiesbaden. He isolated trichomonads with five flagella, morphologically intermediate between *T. hominis* and *T. ardin delteili*, from the blood and vaginae, but when the epidemic was subsiding only *T. vaginalis* could be cultivated from the genital tract. He believed that all human and mammalian strains are variants of a single *Trichomonas* species and that reversible dissociation is responsible for the variety of strains encountered. Abelein (1941*a*) did not support this view, for he considered that the 3-flagellate *T. foetus* is a distinct species from the blood form of Küst (1936) and from other 4-flagellate forms of man and animals. Hees carried out a series of transmission experiments on human volunteers using trichomonads of various pure strains and trichomonads isolated from the blood and uteri of infected cattle. Inoculation of *T. columbae* into healthy vaginae produced no cases of infection and the persons inoculated with these organisms were used as controls. Inoculation of *T. foetus* into vaginae naturally infected with *T. vaginalis* reinvigorated the latter, while *T. foetus* was demonstrable for only a few hours and could not be cultivated. Inoculation of *T. foetus* or *T. vaginalis* into healthy vaginae resulted in the discharge of unaltered trichomonads for 12 days and 15 days respectively, but there was no evidence that either of the organisms multiplied nor could they be cultivated. Cervical inoculation of *T. hominis*, *T. ardin delteili* or the intermediate bovine strain resulted in severe symptoms of *T. vaginalis* infection after eight days. Subcutaneous inoculation of *T. foetus* into patients having no previous history of trichomonads in the blood, faeces, or vaginae was followed in six cases out of ten by *T. vaginalis* genital infection. Attempts to set up infection by oral administration of a single dose of *T. foetus* failed in two cases, but when five large doses were given in six days a generalized *Trichomonas* infection resulted, and after the eighth day the *T. hominis—ardin delteili* group was cultivated from blood and faeces. Two weeks later, large numbers of *T. vaginalis* were found in the vaginal and cervical discharge. Hees believed that cattle may be a source of human epidemics, for the Wiesbaden outbreak coincided with a change in the local milk distribution, involving the pooling of supplies from various herds. He also considered that infection may be carried by dogs, cats, and house flies, although he showed no evidence for this belief.

Transmission through the agency of house flies has been suggested by various authors and has recently been studied by Morgan (1942*a*). He isolated *T. foetus*, for as long as eight hours after ingestion, from the faeces of specimens of *Musca domestica* and considered that, under favourable conditions, infectious material regurgitated 1–5 minutes after ingestion may set up an infection and that flies may disseminate the disease by defaecating on the genitalia of cattle.

The possible existence of reservoirs of infection was suggested by Schoop and Stolz (1939) who isolated trichomonads, morphologically similar to *T. foetus*, but slightly smaller, from the uteri of four out of five roe deer affected with sterility. Later, Schoop (1940) suggested that, if the trichomonads from cattle and deer should prove to be identical, wild animals such as deer might possibly form the source of some outbreaks in bovine animals, presumably by some indirect means. In an attempt to provide more evidence for the theory that animals may serve as a source of infection for human vaginal trichomoniasis, Trussell and McNutt (1941) made intravaginal inoculations of bacteria-free cultures of *T. foetus* and *T. vaginalis* into cattle, swine, sheep, goats, horses, monkeys, guinea pigs, rabbits, cats, and

dogs; of these, only monkeys became infected with *T. vaginalis*, while cattle became infected with *T. foetus*, which also produced transient infection in dogs. Oral, rectal, subcutaneous, intraperitoneal, intravenous, and intracranial inoculations with either organism into some of the above-mentioned animal species and, in addition, chickens, turkeys, and pigeons, failed to produce infection. These authors did not make any inoculations with the bovine trichomonad into human beings, but they considered, from the evidence which they obtained, that the possibility of human infections arising from animal reservoirs is remote. Inoculation of small laboratory animals was made by Jensen (1938), who injected ten pregnant guinea pigs intraperitoneally with material which came from a case of bovine pyometra, but which failed to infect two cows, three heifers, and a bull. Infection and abortion occurred in only one guinea pig and Jensen considered that the trichomonads were of low virulence and that *T. foetus* is not highly pathogenic to healthy, well nourished animals. On the other hand, Zeetti (1940) found that intraperitoneal inoculation of *T. foetus* into female guinea pigs or rabbits killed them, whilst adult males were resistant. Intravaginal inoculation of female rabbits or guinea pigs caused abortion but not death, although young guinea pigs, rats, and dogs of either sex died as a result of intraperitoneal inoculation of cultures and other infective material. Morgan (1942*b*) failed to infect white rats by intravaginal or intraperitoneal inoculation with cultures of *T. foetus* or with bovine pyometra material. White mice were resistant to intravaginal inoculation, but succumbed to intraperitoneal inoculation. Barboni (1940) found that guinea pigs, dogs, mice, and rabbits died as a result of intraperitoneal inoculation with *T. foetus*. Examination P.M. revealed a fibrinous purulent peritonitis and often pleurisy, general hyperaemia, oedema, and haemorrhage, and cloudy swelling and fatty degeneration of the liver, kidneys, and myocardium; in guinea pigs there was some necrosis of the adrenals and calcification of the renal epithelial cells.

4. Immunity

Andrews (1938) confirmed the conclusions reached by previous workers regarding the occurrence of spontaneous cure, refractoriness to reinfection, and the development of acquired resistance. He was unable to determine the exact nature of this resistance, although the finding of *T. foetus*, in one case, after the third attempt at reinfection of a recovered animal, suggested to him either that trichomonads had caused a transient subclinical infection in the "immune" animal, or that this resistance was in the nature of "premunition". Andrews' conclusions were based upon observations made on three heifers; two of these heifers, after recovery from infection by intravaginal inoculation with infective material, resisted several attempts at reinfection by the same means. The third heifer proved refractory to infection by artificial inoculation and by several services with an infected bull. As this animal had been served twice by a known infected bull before coming under observation, it had probably already recovered from a natural infection. In the herd of 40 heifers observed by Andrews and Miller (1938*a*) it was noticed that the severity of the disease appears to decline spontaneously, but whether the infection becomes extinct in time or whether a small residuum of infection remains was not established. They also found that infertile heifers, served repeatedly by infected bulls, appeared to be resistant to reinfection. It was suggested that cows, which have been exposed and presumably infected as heifers, are more productive when served by infected bulls than are heifers. Rees (1937*b*) also observed that recovered cows bore healthy calves although served by infected bulls. Kerr (1943) found that an artificially immunized heifer, which was served by an infected bull, calved normally at full term; some degree of vaginitis occurred although no trichomonads were demonstrable.

An attempt to determine the nature of this resistance was made by Byrne and Nelson (1939) who found that intravaginal inoculation of *T. foetus* into normal female rabbits resulted in infection, lasting on an average 23 days, in 84% of cases. They were able to show that an active immunity developed which, according to their evidence, appeared to be local and was independent of the agglutinin content of the blood.

Morisita (1939) studied, in two pure strains of *T. foetus*, the non-immunological agglomeration which occurred spontaneously in cultures. He also studied the immunological agglomeration and agglutination phenomena; he doubted whether there was any actual difference between serological and non-serological agglomeration, except in the intensity of the reaction. The titre of the agglomeratinin was always found to be higher than that of the agglutinin. Both antibodies were destroyed by exposure to a temperature of 75°C. for 30 minutes in undiluted serum and to 80°C. for 30 minutes in serum diluted 1 : 40. The effect of heat on the antigen was to decrease the antigenic potency in proportion to the degree of heat to which it was exposed. According to Morisita, the phenomenon of agglomeration of protozoa was first described by Laveran and Mesnil in 1900, who defined it as agglutination without paralysis of movement of the living parasite. Most of the theoretical explanations of the mechanism of this phenomenon were based upon studies on *Trypanosoma lewisi*, but the agglutination of trichomonads had been thought to be caused by an abnormal secretion of the parasite, because mucous fluid was seen, chiefly around the projection of the axostyle, when the trichomonad was examined in a living or stained condition.

Robertson (1941) also studied the agglutination of trichomonads and, in her view, the evidence produced by Morisita for the assumption that the solid round agglutination and the more loosely clumped agglomeration are caused by two different antibodies, was based on some rather unconvincing absorption experiments with living and formolized trichomonads. In either case the agglutination reaction disappeared before the agglomeration and she points out that this would also be found if agglomeration were the response of the living organism to the presence of a feeble amount of antibody. Morisita's tests were made in tubes and he seems to have overlooked the very characteristic flat "echelon" clumping and immobilization and shrinking of the trichomonads, which Robertson observed by examining the test suspension and sera in small petri dishes under low powers of the microscope.

Lyford (1941) also observed the occurrence of agglutination and agglomeration and she suggested that in addition to the growth factor, there may be a substance in serum which exerts an inhibitory effect on growth and multiplication. This inhibitory factor may therefore be in the nature of a protective antibody.

5. Diagnosis

Demonstration of living trichomonads in fresh preparations is a valuable means of diagnosis, but the method is not entirely satisfactory because the number of parasites varies during the course of the disease and organisms may not be demonstrable at the time of examination. For example, †G(r)ossmann (1939) could

† This name is spelt "Grossman" in the abst. in *Schweiz. Arch. Tierheilk.*, but is given as "Gossmann" by Abelein, his teacher.

detect trichomonads in only 9·6% of infections by direct microscopic examination.

(*a*) *Collection of Material*

Usually *T. foetus* is easily demonstrable in vaginal mucus following early abortion, but Dikmans and Poelma (1938) noted that swabs taken 24–48 hours after abortion may be negative. Although it is generally suggested that cows giving such negative results should be re-examined on the second day of oestrus when relaxation of the cervix has occurred, Dikmans and Poelma maintained that the irregularity with which these periods occur makes this procedure difficult. In addition, since demonstration of the parasite in preputial swabs from chronically infected bulls may not succeed, they suggest that, in such cases, diagnosis may be made by examination of heifers 2–6 weeks after service by the suspected bulls. This procedure was also recommended by Beller, Schaaf, and Scherle (1938), Beller and Schaaf (1939), and Case and Keefer (1938).

To collect material, Andrews and Miller (1938*a*) devised a special vaginal pipette which was bent in such a way as to allow observation of the instrument through a speculum during insertion and to facilitate the injection and recovery of fluid. By means of this pipette the fluid portion of a Locke-egg-blood medium or Locke-egg-serum medium was injected into the vagina; the fluid was then aspirated and, after this procedure had been repeated several times, the washings were returned to the culture tube and incubated overnight. Moore (1938) quotes Dikmans' (1937) method in which a swab, moistened in saline, was inserted into the vagina or preputial sheath and then replaced in a tube of saline to which 5% aqueous iodine solution (about 20 drops to 8 ml. of saline) was added. The tube was then tightly corked and placed in the refrigerator The trichomonads were said to be well preserved and stained by this method for a period up to 5–6 weeks. The method was particularly recommended for material to be sent to a laboratory.

To detect *T. foetus* in bulls, Andrews and Miller (1938*b*) obtained samples of ejaculate from the sheaths, seminal vesicles, and ampullae ducti deferentis by intrarectal massage. The incidence of positive findings by direct microscopy was 47%, by culture 13%, and by both methods combined 57%. They found trichomonads more frequently in the ejaculate than in the sheath washings. Of 13 bulls examined 1–20 times, at least 12 were infected, but only seven of these were detected by microscopical and cultural examinations, *i.e.*, an efficiency of approximately 50%. The other five cases were known from their breeding history or by P.M. examination to be infected. The percentage of positive cases detected increased with the number of examinations. Thus, animals examined once, twice, three, and four times gave respectively 33, 50, 67, and 80% of positive results, while all bulls examined five times or more were positive. When a first examination was negative, Abelein (1941*b*) recommended a second one after eight days. He examined 281 bulls and found 150 to be infected; of these, 134 were detected at the first, 12 at the second, and four at the third examination. Of 110 bulls which were negative, three were later infective for cows, but they may have become infected after the examination. For the collection of preputial secretion, Abelein devised a special brush which was adapted by Swangard (1941) for cows or bulls. This instrument was described by Swangard with the aid of a detailed illustration and consisted essentially of a tube, 25 in. long with a diameter of ¼ in., through which ran a wire having a small brush attached to the distal end. The apparatus was inserted into the prepuce or fornix, or cervix if open. On loosening a set screw the wire could be pushed forward, rotated to pick up the sample by means of the brush, and then withdrawn into the tube. The instrument could be locked before withdrawal from the body so that an uncontaminated sample was obtained.

In abortion due to trichomoniasis, trichomonads may usually be obtained from the mouth and stomach contents of the foetus, but Case and Keefer (1938) found that the mucus at the base of the tongue offered the most reliable material for examination.

(*b*) *Staining*

Various attempts to stain the parasites have been made, but none appears to be wholly satisfactory. Robinson (1937) used Giemsa stain for 12 hours after moist fixation in sublimate alcohol; he also used May-Grünewald followed by Giemsa stain as recommended by Stableforth, Scorgie, and Gould (1937). A rapid method, which is said to be satisfactory, was developed by Stewart (1938*b*) as follows. After fixation in osmic acid vapour for about 10–30 seconds, the smears are stained in 5 drops of Wright's blood stain to which are added 15 drops of Sørensen's buffered solution with a pH between 7 and 7·6. The diluted stain is left to act for about two minutes and the slide is then washed thoroughly with Sørensen's solution, dried, and examined. The entire process requires only 15 minutes and the flagellates stain uniformly according to the characteristic Romanowsky reactions. Morisita (1939) obtained the best results by fixation in Schaudinn's fluid and osmic acid vapour, and by staining with Giemsa and with Heidenhain's iron haematoxylin. Dobell (1942) used aqueous haematoxylin, after mordanting in an aqueous solution of ammonium molybdate, for *T. hominis*, a very difficult flagellate to stain.

(*c*) *Diagnosis* (*Serological*)

In recent years, much attention has been given to diagnosis by serological methods. Endress (1939) found that the sera of experimentally infected cattle gave positive results to the complement-fixation test. Such results were often only obtained a month after trichomonads had been detected by direct microscopical examination, and later they might become negative although organisms could still be demonstrated. Since the sera of animals in which trichomonads were isolated from the blood did not react to the complement-fixation test, Endress concluded that such organisms constituted a different species. This test could not be relied upon to detect all infected cases as healthy animals also gave positive reactions and, furthermore, the undiluted sera of both infected and healthy animals caused agglomeration and lysis of the trichomonads. The characteristic type of agglutination of *T. foetus* and allied trichomonads in immune rabbit sera was studied by Robertson (1941), and the results formed the basis of a practical test for application to *T. foetus* infections in cattle. It was not designed primarily as a test for the presence of trichomonad infection, but merely as a measure of the rise in the agglutination titre of the blood for trichomonads. Kerr and Robertson (1941) carried out the agglutination test on 120 animals which had positive or suspicious histories of trichomoniasis. Out of 25 positive reactors, trichomonads were seen in nine cases. No animals with a completely normal history, nor virgin heifers, nor animals infected with *Corynebacterium pyogenes* or *Brucella abortus*, gave positive reactions. Although there was a clear connexion between a positive blood titre and uncomplicated infection with *T. foetus*, a negative result

did not indicate absence of infection. Abortion occurred in 13 of the 25 positive cases and a positive titre was found in some cases immediately after abortion and in others after a return of oestrus at six weeks accompanied by a vaginal discharge heavily infected with *T. foetus*. The authors concluded that the test was of value in detecting certain types of cases, and stated that "in practice it may be considered that if one animal with a definitely positive serum reaction is found in a herd it is an indication of a serious *Trichomonas* infection, whether the organism can be found or not". Recently, Kerr (1943) has stated that all infected animals do not react to this test which gives an "over-all result of 60 per cent". He emphasized that the value of the test lay in its ability to detect trichomoniasis in the herd rather than in the individual. Zeetti (1940) also found that non-specific positive results were sometimes given by control animals, although experimentally inoculated guinea pigs, rabbits, and dogs gave positive reactions to precipitation, agglutination, and complement-fixation tests, with an antigen derived from peritoneal exudate of artificially infected guinea pigs.

(*d*) *Diagnosis* (*Artificial Culture Media*)

Cultural methods are frequently used to aid diagnosis. Avery and Garlick (1940) found that a simple egg slant covered with 0·75% sodium chloride was more efficient than a Ringer's-egg-blood medium for diagnostic purposes, but trichomonads failed to survive the second or third transfer. In continuous cultivation, the chief difficulty is to overcome bacterial contamination. Rees (1937*a*) established bacteria-free pure lines of *T. foetus* by a simple method of micro-isolation of the organisms from vaginal fluid and by their transfer to hanging drops on sterile glass strips. The organisms were then inoculated into a medium of egg and serum in Ringer's solution. Later (Rees, 1938*b*), this medium was modified to comprise coagulated whole egg covered with Ringer's solution enriched by 0·2% glucose and 0·5% defibrinated whole blood; similar media have also been used by Andrews and von Brand (1938), Stewart (1938*a*), and Madsen and Jensen (1940). A mechanical method of isolation devised by Stone and Reynolds (1939) was dependent upon the influence of the force of gravity on the migration of motile protozoa. A suspension of protozoa and contaminating bacteria was inoculated into a capillary tube, having a series of bends or traps and containing a sterile fluid medium, and was incubated in the vertical position. The bacteria were trapped at the first or second bend, but the trichomonads migrated downwards and were isolated by cutting off the distal end of the tube and inoculating its contents into a suitable medium. Glaser and Coria's (1935) V-tube migration method was modified by Andrews and Lyford (1940) who substituted sterile petri dishes for the V-tubes, since trichomonads migrate radially in all directions as well as vertically. For primary isolation, a drop of the inoculum was placed in the centre of a dish containing a saline-agar-blood medium; for culture maintenance, a modified Boeck and Drbohlav's (Locke's-egg-blood) medium was inoculated with material taken a little distance from the point of inoculation of the primary culture, the Locke's solution in the medium being replaced by 0·7% sodium chloride solution. The medium was enriched with various substances, the best being defibrinated blood. A comparison of this medium with a serum-glucose-broth medium showed that at 37°C. the latter maintained a heavier growth than the saline-egg-medium, but for a shorter time. Since, however, a serum-glucose-broth culture would not develop from less than 1,000 organisms and growth was started in the saline-egg-blood medium with an inoculum of less than ten organisms, the latter medium was more satisfactory for routine purposes. Sedlmeier (1942) described a transparent semi-solid medium, consisting of glucose agar and the same quantity of a mixture of peptone broth and horse serum in equal parts, distributed in petri dishes, one half of which was sown with *Chromobacterium prodigiosum* and the other half with trichomonad material. The method was said to be useful for freeing cultures from contaminants such as corynebacteria, and for the isolation of trichomonads from pyometra material, but not from preputial secretion.

Various authors, including Schwägerl (1937), Cailleau (1937*a* and 1938), Vinatzer (1938), and Kerr and Lamont (1938) have modified broth media by the addition of tissues such as uterine mucous membrane, udder, testis, oesophageal and oral mucous membranes, parotid gland, tracheal cartilage, tendon, bone marrow, adipose tissue, preputial mucous membrane, corpus luteum, pieces of blood clot, egg-yolk, glucose, bile, extract of yeast, living and killed *Bacterium shigae*, and sera of various animals. As a result of adding alcohol- and acetone-extracts of liver and cholesterol, Cailleau (1938) showed that cholesterol and ascorbic acid were necessary growth factors which *T. foetus* was unable to synthesize. Jírovec and Rodová (1940) obtained optimum growth of *T. elongata*, *T. vaginalis*, *T. parva*, and *T. batrachorum* in buffered Ringer's solution or simply in 0·6% saline, containing 5% serum (human and horse sera proved most suitable). They claimed that this medium was sterilizable without damage and thus permitted the use of non-sterile serum, that it was much simpler to prepare than other similar media, and that it was suitable for diagnosis as well as for continuous cultivation. A covering of paraffin increased the life of the culture in most cases by 2–4 weeks, and the addition of rice starch gave a more luxuriant growth. All the trichomonads multiplied over a wide range of acidity, but the optimum growth occurred at pH 6·5–7·5. Daniel (1940) recommended a medium containing no thermolabile substance. He used Rees' (1937*a*) medium, but the entire mixture was autoclaved at 15–18 lb. pressure for 15–20 minutes. Horse, cow, or sheep serum in amounts varying from 0·5–4% were used with little effect on longevity of the cultures except that, sometimes, individual tubes showed increased life with larger amounts of serum. Disadvantages were that a flocculent precipitate formed after several days' standing and the initial rate of division and maximum number of organisms per ml. were sometimes less than in media containing unautoclaved serum. The method, however, seemed to offer a means of long-continued bacteria-free cultivation when sterile serum was difficult to obtain or where filtration was difficult. The danger of bacterial contamination was also reduced since the tubes did not have to be opened twice, first for the introduction of serum and again for inoculation. Schneider (1942*a*) isolated *T. foetus* from vaginal washings by the Glaser-Coria V-tube method using the following semi-solid medium: 50 ml. "sodium carbonate solution" and 4 ml. bovine serum (pH 7·2), 3 ml. 2% serum agar, 0·1 ml. haematein solution (containing 0·5 mg. haematein), and 0·2 ml. 1·6% alcoholic solution of brom-cresol purple (to indicate pH changes accompanying flagellate growth). For each V-tube, 22 ml. of medium was used and the whole was sterilized by autoclaving for 30 minutes at 15 lb. pressure. This medium was later modified by the addition of dried pulverized egg-shell. Evaporation of liquid was prevented by a covering of "Parafilm" or by sealing the culture tubes. At 37°C., cultures lasted 30–60 days and subcultures were easily started. Washing the infective material by centri-

fugation increased the motility of the trichomonads, thereby increasing the chances of successful isolation. Further data concerning growth of *T. foetus* under these partially anaerobic conditions were given by Schneider (1942*b*). Cultures were maintained for nearly two years; at 37°C., individual cultures lasted 30–72 days and at 22°–25°C., the flagellates lived 3–4 months. The longest-lived cultures recorded were 139 and 147 days old respectively, and subcultures were easily started from them. After prolonged storing at room temperature (22°–25°C.), incubation at 37°C. for 3–10 days permitted the organisms to multiply in sufficient numbers to allow successful subinoculations. Schneider modified his medium slightly so that it comprised solid slants consisting of whole egg mixed with defibrinated bovine blood and sodium carbonate solution. The solidified slants were covered by a solution containing sodium citrate and other salts, 5·0–7·5% bovine serum (pH 7·2–7·4), and, in each litre, 2 ml. bromcresol purple and 40 mg. haematein dissolved in 8 ml. distilled water; dried, ground egg-shell was added to a height of 5–10 mm. at the bottom of the egg slant. The medium was then autoclaved for 30 minutes at 15 lb. pressure.

For their transmission experiments with *T. foetus* and *T. vaginalis*, Trussell and McNutt (1941) used egg slants covered with fresh sheep blood in Ringer's solution or with autoclaved serum. *T. vaginalis* was maintained on liver-infusion agar slants covered with 5% human serum in Locke's solution. For cultural examination of the inoculated animals, 5% human serum in Ringer's solution over placenta agar slants was used for *T. vaginalis* and the stock egg medium as above for *T. foetus*.

Bacterial contamination of cultures was obviated by Pingerra (1937) by the addition of trypaflavine (1 : 300,000), sodium azide (1 : 10,000), and sodium fluoride (1 : 5,000), and by Schoop and Oehlkers (1939), who used a medium containing a minimum of protein, consisting of 100 ml. saline, 0·2 ml. of a solution consisting of 8·7 g. primary and 165 g. secondary potassium phosphates in 1,000 g. water, 10–12 drops of bovine serum, and a pinch of rice starch.

(*e*) *Diagnosis* (*Chick-Embryo Inoculation*)

Developing chick embryos have also been used for the cultivation of trichomonads. Nelson (1938) inoculated *T. foetus* from Locke's-egg-blood cultures into the allantoic cavity of chick embryos 11–12 days old. Transfers were made at intervals of 3–4 days provided that the trichomonads were abundant in the allantoic fluid. This strain of *T. foetus* was grown through 14 generations and it seemed probable that it could have been continued much longer. Levine, Brandly, and Graham (1939), without referring to Nelson's paper, also used 12-day-old chick embryos and made 22 serial transfers over a three-months' period. They found that trichomonads survived in allantoic fluid in cotton-plugged test tubes for several days at room temperature, but in the egg, death of the embryo was soon followed by death of the trichomonads. The flagellates appeared to have no pathogenic effect on the embryos, for normal chicks hatched out if incubated for the full period, by which time, it was said, the parasites were no longer present, the allantoic fluid having disappeared. Hogue (1939) inoculated embryos 8–16 days old and recovered trichomonads from the digestive tract, gall bladder, and yolk sac of older embryos. Four inoculated embryos hatched as normal chicks; one was infected and three uninfected with *T. foetus*. Hogue found that the organisms lived in the eggs 6–7 days after the embryos had died. Attempts to infect young chickens were unsuccessful. Hogue (1938*a*) also found that trichomonads might have a very injurious effect on the cells of chick embryos when grown in tissue cultures. Filtrates of a 17-day-old culture were practically as lethal as living *T. foetus* and cultures heated to 55°C. for 15 minutes were almost as toxic as the living parasites. This toxic substance was stable at 55°C., but was destroyed by heating to 60°C.; it did not seem to be of the nature of an enzyme, since it did not digest starch or protein. It destroyed the epithelium, fibroblasts, and nerves of tissue cultures of the amnion and intestine of eight-day-old chick embryos (Hogue, 1938*b*). McNutt and Trussell (1941) cultivated *T. vaginalis* and *T. foetus* in chick embryos, but they concluded that these organisms were not pathogenic to the embryos because they found that the trichomonads developed in the allantoic and amniotic fluids, but not in the egg albumen or yolk nor in the embryo itself nor in its bloodstream.

6. Metabolism

During an extensive *in vitro* study of *T. foetus*, Morisita (1939) maintained cultures in 5% glucose neutral broth and on whole-egg agar slants; the addition of 0·5–1·0% glucose favoured growth. Best growth occurred at pH 6·6–7·8, although the trichomonads survived between pH 5·6 and 8·4. The optimum temperature was 30°–37°C.; below 27°C. there was no development and at 40°C. the flagellates soon became non-motile and died. Morisita studied the fermentation and utilization by the parasite of various sugars in broth. He also found that preparations of vitamins B and C and of pancreatic hormone stimulated multiplication, whilst vitamin A and thyroid hormone were definitely injurious; this effect in the case of vitamin A may have been due to the solvent. A water extract of the parasite prepared by grinding the parasites in distilled water also favoured its growth when added in suitable quantities. He confirmed that cultures grew best under anaerobic conditions; this was also confirmed by Lyford (1941), and by Johnson (1942) who maintained *T. vaginalis* on Difco liver-infusion agar slants covered with a modified Ringer's solution containing human serum. Optimum growth occurred at pH 5·5–6·0, multiplication being limited or stopped below pH 5·0 and above 7·55.

Lyford (1941) studied the biology of *T. foetus* with particular reference to longevity, relationship between blood sera and cultivation, transfer requirements, temperature, H-ion concentration, effect of metabolic excretions on reproduction, and carbohydrate metabolism. She maintained *T. foetus* in sealed ampoules of saline-egg-blood medium (Andrews and Lyford, 1940) for about 99 days at room temperature without transfer. When either egg-yolk or egg-albumen was substituted for whole egg in this medium, results were unsatisfactory, the only medium for long-continued cultivation being the whole-egg slant covered with saline and blood. It was evident that the size of the inoculum had a definite bearing on the density and longevity of the trichomonads in glucose-serum broth because the number of trichomonads living simultaneously was much greater when 100,000 organisms per ml. were inoculated into this medium than when 1,000 per ml. were inoculated. Morisita (1939) found that the growth factor in blood serum was destroyed by heating to 70°C. for 30 minutes. Lyford (1941), on the other hand, found that this factor in rabbit serum was stable at 4°C. for at least five months. She was able to grow *T. foetus* in glucose-serum broth, with an optimum serum concentration of 40%, whether the serum was obtained from male or female rabbits or from pregnant or non-pregnant animals. Such cultures could not be developed from other broth cultures if the material used as inoculum was in a state

of decline as far as the trichomonad count curve was concerned. Transfer from saline-egg-blood culture to glucose-serum-broth was almost impossible if the former culture was more than 72 hours old; when stock cultures were not transferred at the usual ten-day intervals, they became increasingly difficult to transfer successfully. As the growth of the organism in glucose-serum-broth increased, there was an accompanying decrease in the pH in direct proportion to the number of flagellates produced in the culture; the final pH after all trichomonads had died was 4·8, but this acidity was not thought to be the cause of death. Metabolic products in old culture filtrates had a definite inhibitory effect on the growth of trichomonads inoculated into new media even when the filtrate was present in only 1% concentration. As to the influence of temperature, Lyford found that some organisms were not instantly killed by heat until a temperature of 52°C. had been reached and that trichomonads could live for 14 days at 4°C. Zeetti (1940) also reported that trichomonads retained their vitality *in vitro* longer (6–15 days) at 5°C. than they did at temperatures below or much above this figure, but some remained active up to ten days at 20°C.

The properties and growth requirements of *T. foetus* have also been studied by Cailleau (1937*a*) who found that this parasite fermented various substances including glucose, galactose, lactose, laevulose, maltose, saccharose, dextrin, and soluble starch with strong acid production, inulin with slight acid production, and with no acid production in the case of arabinose, xylose, rhamnose, glycerin, erythrite, sorbite, dulcite, and mannite. Stewart (1938*a*) found a definite relationship between the consumption of carbohydrates and the accumulation of glycogen. *T. foetus* stained with iodine showed diffuse glycogen inclusions, which increased in number with the growth of the organism. The number of glycogen-containing trichomonads increased from the time of their inoculation into the culture medium (glucose-serum broth) until the total trichomonad count reached its maximum; it thereafter decreased. Death of the trichomonads coincided with a decrease in both numbers and percentage of organisms with high glycogen content. Stewart agreed with Andrews and von Brand (1938) that death was not due to deficiency or exhaustion of carbohydrates, serum, or both in the culture. Glucose utilization was also studied by the latter authors. They determined the sugar content at the beginning and end of each experiment and noted daily fluctuations of the organisms present. The average rate of glucose consumption was found to vary, being high (over 350 mg. per 1,000 million trichomonads) during a 24-hour period in which the number of the organisms was increasing, and low (under 200 mg. per 1,000 million) when they were dying out in cultures. Unless a concentration of at least 0·1% glucose in serum was maintained, the multiplication rate of the trichomonads was depressed, although they survived for considerable periods of time. Lyford (1941) also studied carbohydrate metabolism by comparing numbers of dividing multinucleate trichomonads and glycogen-containing organisms, and the longevity of trichomonads, in glucose-serum broth and glucose ascitic fluid broth. She found that, whilst the percentage of glycogen-containing flagellates was approximately the same in both cultures, the number of multinucleate forms was higher in glucose-serum broth. The percentage of flagellates containing more than one nucleus remained relatively constant in glucose-serum broth, and showed a slight increase after the time when the maximum count was made; the percentage of dividing forms in each medium was not consistently different. The glycogen curves showed a gradual fall, in contrast to the slight rise in multinucleate curves, which indicated that the glycogen contained within trichomonads *in vitro* was not directly concerned with reproduction.

Morisita (1939) tested the lethal action of various chemical agents *in vitro* and the effects of vital staining on *T. foetus*. The temperature and pH of the medium were both important factors. Thus, at high temperatures the time required for taking up the dye and excreting it was shortened, and in old cultures, in which the reaction had become acid, the trichomonads did not respond to vital staining because of the acidity of the medium and the functional inactivity of the parasites. The stained cytoplasmic granules numbered 20–30 and the nucleus, blepharoplast, flagella, and fibrillae stained only when the parasite was near death. The parabasal body, undulating membrane, and axostyle could not be dyed. Oxidation and reduction capacity was also examined; this ability was stronger in young healthy parasites than in degenerating forms, and the quantity of oxidase was directly proportional to the reduction power. Oxidation localities were distributed in the cytoplasm, nucleus, and blepharoplast, while reduction localities and the distribution of oxidase were restricted to the cytoplasm. There was no evidence of the presence of peroxidase. Trichomonads in young cultures had greater reduction than oxidation capacity, whilst the opposite occurred in old cultures.

7. Treatment and Control

Measures to control bovine trichomoniasis were recommended by Stableforth, Scorgie, and Gould (1937). Since then many authors have suggested various other measures, which all depend upon the same broad principles of hygiene. The local therapeutic action of numerous drugs has also been investigated and the most widely used agent still appears to be an aqueous solution of iodine in varying strengths.

Uhlenhaut (1937) advocated preputial irrigation, before and after service, with 2% sodium perborate, 1% alum, 1% "valvanol", or 0·1% trypaflavine. He found artificial insemination to be the most effective method of preventing the spread of infection. Swangard (1939), however, did not recommend douching of the male or female before or after service. For control purposes, he (1938 and 1939) advised division of the herd into (a) uninfected cows and virgin heifers, to be served by a "clean" bull; (b) pregnant cows, closely observed for evidence of pyometra; (c) infective animals which receive curative treatment.

Andrews and Miller (1938*b*) maintained that prevention was the only satisfactory means of control in bulls. They recommended breeding "clean" bulls only to unexposed heifers and cows by natural service, and breeding exposed females either to infected bulls naturally or to "clean" bulls by artificial insemination. Similar methods were outlined by Rees and Garlick (1939) and by McNutt and Walsh (1939). Gilyard and Gilyard (1942) advocated that any female, which had not conceived after service by an infected bull, should be rested for three regular successive heats; if the cycle was irregular, oestrus should be induced by expulsion of the corpus luteum. After this rest period, the animal might be served by the infected bull, and pregnancy was likely to result. With this procedure, there was less tendency for abortion or pyometra to follow and, in fact, a tolerance seemed to be built up and normal calves were delivered at full term. Non-pregnant, previously exposed females should not be served by a "clean" bull for, although they might have an acquired resistance, they could still be temporary carriers. These authors considered that the intervention

of a full-term pregnancy with a viable calf was sufficient grounds for return of the dam to a "clean" bull, *i.e.*, they did not believe that trichomonads survived pregnancy. When the chronic male carrier had to be used, he was only allowed to serve tolerant cows. Parturition did not appear to influence the acquired resistance, and pregnancy occurred quite readily when these tolerant cows were again served by the bull which, meanwhile, remained infected. When prompt eradication was preferred to the maintenance of carrier sires, infected bulls were slaughtered and exposed barren females were inseminated artificially from a clean bull after the recommended period of breeding rest.

As regards therapy, Euler (1937) found entozon solution much less satisfactory than aqueous iodine solution for uterine irrigation. Pallaske and Volkmann (1938) recommended uterine irrigation with rivanol, entozon, and 5% aqueous iodine solution (1 : 3 : 100 and 1 : 2·5 : 100). For treatment of pyometra, Swangard (1938) first enucleated the corpus luteum and gave at least once daily for the next 3–4 days a vaginal douche with 2–5% sodium perborate solution. Then 100 ml. of 1% solution of iodine was injected through the cervix. The douches were repeated for a few more days after expulsion of the iodine solution had ceased. In cows with no uterine involvement, Swangard found that persistent douching sufficed to clear the infection. Madsen and Jensen (1940) treated a case of pyometra by enucleation of the corpus luteum followed by irrigation with 0·1% aqueous solution of potassium orthoxy quinoline sulphonate; within four days the uterus was apparently normal and pregnancy followed a second mating.

Uhlenhaut (1937) investigated various methods of applying medicaments to bulls, and concluded that agents in ointment, solid, or powder form could not be relied upon to reach every part of the preputial mucous membrane and that preputial irrigation was the only effective method. Abelein (1938) used trypaflavine solution for urethral irrigation and "bovoflavine" ointment (a trypaflavine preparation) for the preputial sac. Various strengths were tested and best results were obtained with 0·1% trypaflavine solution and 0·5% "bovoflavine" ointment. The bulls were cast and the treatment was applied under epidural anaesthesia. Swangard (1938) also treated bulls according to Abelein's method, inducing anaesthesia with 7 ml. per cwt. body weight of 2% tutocaine solution epidurally. When redescribing the same procedure in 1939, Swangard recommended 7 ml. per 100 lb. body weight of 1% tutocaine. After casting and securing the bull in the lateral or dorsal position, the hair at the prepuce opening was shorn and the penis unsheathed. It was often necessary to use suction into a glass tube to bring the penis forward. While an assistant held the distal part of the penis with a clean cloth, the preputial mucosa was exposed and gently but thoroughly massaged with 75–100 c.c. of 0·5% trypaflavine ointment, particular attention being paid to the folds and crevices near the urethral opening. After the ointment had been applied for at least 10 minutes, a catheter was introduced into the urethra for 2–3 inches and 30 ml. of a 0·1% trypaflavine solution were injected. The penis was then resheathed and the preputial opening was well covered with ointment and tied with string to prevent unsheathing, the string being removed when the anaesthesia had worn off. This treatment was repeated after 7–10 days. Later, in 1941, Swangard recommended a 0·4% trypaflavine ointment to obviate any subsequent irritation. Gould (1939) douched the prepuce of bulls twice a week with 5% lactic acid, and stressed that a rest period of at least three months was essential to the treatment of bulls as well as of cows.

Abelein (1941*c*), from a study of the gross and histological anatomy of the preputial sac, emphasized that the presence of crypt-like folds of mucosa, in which trichomonads may lodge, offered the chief difficulty in the successful treatment of bulls and that simple irrigation was, therefore, of little use. He treated 122 bulls, of which 103 were infected and 19 were doubtful, under epidural anaesthesia as already described. The infected bulls were treated with trypaflavine or "bovoflavine" ointment applied to the penis and preputial sac, together with irrigation of the urethra with trypaflavine solution. Varying strengths of the drugs were tested and of 24 bulls treated with "bovoflavine" ointment in concentrations of 0·5–1·0% and with trypaflavine solution of 0·2–1·0%, 20 were cured, although four had to be destroyed owing to necrosis; of 57 bulls treated with 0·5% ointment and 0·1% solution, 55 were cured after 2–4 weeks, but two still showed trichomonads; of 13 bulls treated with 0·4% ointment and 0·1% solution, 11 were cured and two remained infected; of nine bulls treated with 0·3% ointment and 0·1% solution, eight were cured and only one remained infected. Nine of 29 bulls so treated later showed infection when used for service, but Abelein thought that they had probably become reinfected after service. He advised microscopical examination of preputial secretion 14–21 days after the end of treatment; the apparently clean bulls were then allowed to serve a limited number of heifers, which were examined after 14 days, and only if these tests were satisfactory was the bull used for general service.

Although treatment of infected bulls has thus been successful in some cases—and unless bulls are cured they remain permanent carriers—treatment is not generally undertaken in Great Britain owing to practical difficulties as well as to economic considerations.

A comparative study of the effects of various chemotherapeutic agents on rat trichomonads *in vivo* was made by Nelson and Tatum (1938). *In vitro* tests were also made on cultures of rat trichomonads and *T. vaginalis*. Twelve organic arsenicals, including mapharsen, acetarsone, carbarsone, and tryparsamide were used as well as quinine, emetine, calomel, and chiniofon [quinoxyl]. Ten pentavalent arsenicals, one trivalent arsenical, and chiniofon, administered orally, were effective against rat trichomonads. Five pentavalent arsenicals had favourable therapeutic indices when administered either intramuscularly or intravenously. Carbarsone was effective when given by the intramuscular route but not by the intravenous route. For agents effective by any route, oral administration was far superior to intramuscular and intravenous, and intramuscular administration was more successful than intravenous. The comparative *in vitro* action of drugs on *T. parva* (rats) and *T. vaginalis*, was difficult to determine, but *T. parva* appeared to be more susceptible than *T. vaginalis* to arsenicals and less susceptible to quinine and emetine. Kerr (1942–43) found that 25% of *T. foetus* were motile after 1 minute's exposure to peptone saline containing 1% acriflavine, brilliant green, or gentian violet, or 2% lactic acid, but that no organisms were motile after the same exposure to 0·02% aqueous iodine solution or 0·2% merfenil.

Of the newer drugs, Hanschell (1943) reported that vaginal insufflation daily with propamidine in two cases of infection with *T. vaginalis* was followed by rapid diminution of symptoms and disappearance of organisms in the vaginal exudate.

As yet there appear to be no records of the use of any of the diamidine compounds against *T. foetus*. In

view of their great therapeutic value against trypsnosomes and piroplasms, it seems that an investigation might, with advantage, be made of their action in trichomoniasis.

B.—TRICHOMONIASIS IN OTHER MAMMALS

Besides cattle, trichomonads have been recovered from a number of mammals and, in addition to records of their presence in the intestinal tract of dogs, cats, rats, and sheep, they have more recently been reported from the mouths of dogs (Simitch 1938, and Simitch and Kostitch 1938), of horses and asses (Simitch 1939), and from facial lesions in a pig (Hegner and Alicata 1938). They have also been cultivated from the genital tract of horses (Petersen 1937), and of roedeer (Schoop and Stolz, 1939).

C.—TRICHOMONIASIS IN BIRDS

1. Incidence and Classification

A disease associated with trichomonads in pigeons was first described by Rivolta in 1878. It has since been reported from Rumania, Hungary, Austria, Germany, Switzerland, France, Holland, South Africa, the United States of America, Japan, Curaçao, and the West Indies. Trichomoniasis of turkeys has been reported in the U.S.A., and of chickens in the U.S.A., Russia, and Germany. Trichomonads have also been recorded by various authors in hawks, ducks, guinea fowls, ring doves and mourning doves, sparrow hawks, peregrine falcons, and in an Indian dove introduced into Australia (Hart, 1940). Callender and Simmons (1937) recovered trichomonads from a Java sparrow and they were able to transmit a fatal infection to a Tovi parakeet and a Verraux's dove.

Oehlkers (1937) examined 828 pigeons and found that 56·6% carried trichomonads on the oesophageal mucous membrane. Stabler (1937) found trichomonads in 82·4% of pigeons examined, and in eight of 26 hawks, but not in owls, robins, or swallows. In a further survey, Stabler (1941*a*) examined 242 pigeons, of which 64·5% were infected, and none of these showed lesions attributable to trichomoniasis. Included in this survey were 26 doves, 12 domestic turkeys, 41 raptorial birds (birds of prey) and 91 birds of various species, and of all these only 12 Raptores carried trichomonads.

The classification of avian trichomonads shows much confusion, because some authors believe that different species occur in the upper and lower digestive tract of the same bird as well as in different birds, whilst others maintain that all avian forms are the same species.

The morphology of pigeon trichomonads was described by Nieschulz and Bos (1936), who drew attention to the fact that the trichomonads isolated from the mouth and crop and from the liver of pigeons by Rivolta, were named by him *Cercomonas gallinae* and *C. hepatica* respectively. The specific name *columbae* was not given by Rivolta but was introduced after 1878. Nieschulz and Bos pointed out that *C. gallinae* and *C. hepatica* were identical and they recognized the priority of Rivolta's names over *T. columbae*, but they considered that *T. hepatica*, and not *T. gallinae*, was the correct name, since this trichomonad was a parasite of pigeons and not of fowls. They thus regarded *T. columbae* and *T. columbarum* as synonyms of *T. hepatica*. They described *T. hepatica* as possessing two pairs of anterior flagella of unequal length but equally paired; the undulating membrane generally ended some distance in front of the posterior end and the axostyle was slender. Schaaf and Schmitt (1937) referred to this pigeon parasite as *T. columbae*, but they agreed with Nieschulz and Bos that there were four anterior flagella, although occasionally a fifth, thicker one was evident. On the other hand, Miessner and Hansen (1936), in the course of extensive observations upon this disease. described *T. columbae* as possessing 1–4 flagella, Stabler (1938*b*) considered that *T. gallinae* (Rivolta, 1878) was the correct name and, in his opinion, the name *T. hepatica* proposed by Nieschulz and Bos was not tenable. Because only one type had been described from the mouth, crop, and liver, although Rivolta gave two names to the same flagellate from different regions in different pigeons, and first called the organisms *Cercomonas gallinae* in 1878, Stabler maintained that there was no justification for the revival of *C. hepaticum* or for the use of *T. columbae* Rivolta and Delprato (1880), which thus became synonyms of *T. gallinae* (Rivolta, 1878).

In view of the confusion concerning the morphology and nomenclature, Stabler (1941*b*) obtained trichomonads from the upper digestive tract of pigeons, domestic turkeys, golden eagles, and several species of hawks, and made observations upon specimens fixed in Schaudinn's fluid plus 5% acetic acid or in weak Flemming's solution, and stained with Heidenhain's iron-alum haematoxylin or Giemsa's stain. The average size of trichomonads from six types of avian hosts was $10{\cdot}5 \times 5{\cdot}2\mu$, with a range of $6{\cdot}2$–$18{\cdot}9 \times 2{\cdot}5$–$8{\cdot}5\mu$—figures which closely agree with those recorded by Hawn (1937) and Schaaf and Scherle (1938*b*). The blepharoplast was situated at the extreme anterior end and did not appear to be composed of separate granules as described by Morisita (1939) in *T. foetus*. Although the axostyle had been described as being composed of two parallel fibrils and as leaving the body through a circular opening in the cytoplasm (Volkmar, 1931), as arising at about the level of the middle of the nucleus (Callender and Simmons, 1937), and as being nearly as narrow as the anterior flagella (Hawn, 1937), Stabler could not confirm any of these observations. He recorded the morphological features as follows :– the axostyle was of the *T. vaginalis* type, being narrow and devoid of internal granules, and protruding for a short distance beyond the posterior end of the body; the parabasal apparatus consisted of a long fibrillar portion, and a shorter, thicker element; the fibril, sometimes more conspicuous than the axostyle, continued almost to the posterior end of the body; the thicker parabasal body, disposed along the dorsal sides of the fibril, averaged $3{\cdot}6\mu$ in length, and was most evident after fixation in osmic acid or Flemming's solution. Stabler confirmed the observations of most authors that there were definitely four anterior flagella, but he found them to be of approximately equal length, ranging from $7{\cdot}7$–$13{\cdot}1\mu$, and averaging $9{\cdot}9\mu$. Other structures were as follows :– the marginal filament, occasionally seen as a double structure extending for two-thirds to three-quarters of the body length, was never continued as a free posterior flagellum; the costa extended along the base of the undulating membrane, from the blepharoplast to the posterior tip of the marginal filament; the mouth, whose existence was confirmed by the presence of ingested white blood cells, was difficult to detect, and was situated anteriorly

extending along the ventral side of the axostyle opposite the nucleus.

A new species, *T. diversa*, was isolated from the upper digestive tract of turkeys by Volkmar (1931) and re-described by Hawn (1937) who believed it to be a different species from those present in the lower digestive tract. He did not attempt to identify the caecal flagellates, but recognized them as a morphologically distinct species. His specimens of *T. diversa*, isolated from the upper digestive tract and occasionally from the duodenum and caeca, appeared to have four anterior flagella and showed great motility.

Stabler (1938*a*), suspecting that *T. diversa* might be the same parasite as the "so-called *T. columbae*" of pigeons, attempted to infect a turkey by smearing its mouth with material from an infected pigeon. Trichomonads were present for at least 61 days and the bird showed no sign of illness. Cultures made from this turkey were given to a second turkey which became infected and was severely ill for nearly two weeks, recovered, and retained trichomonads for at least 54 days. Cultures from this bird were fed to a "clean" pigeon which became affected with trichomoniasis identical with that in the first pigeon. On this evidence, Stabler concluded that *T. diversa* was identical with the pigeon trichomonad, and that the pigeon was the ultimate source of infection for both turkeys and pigeons; the latter conclusion was endorsed by Levine, Boley, and Hester (1941).

Allen (1941) described a five-flagellate trichomonad from the caeca of fowls and turkeys. She had previously given to this flagellate the generic name of *Pentatrichomonas*, but later considered that it was identical with *T. gallinarum* Martin and Robertson, 1911, although only four flagella were apparently seen in the latter species. Allen considered that the genus *Trichomonas* should include all forms having 3–5 anterior flagella, and since the name *T. gallinarum* was well established, it should be retained for this parasite of fowls and turkeys. The fifth anterior flagellum was much shorter than the other four, which were apparently of equal length. The undulating membrane was attached along the entire length of one side of the body. In fresh preparations, this trichomonad was seen to exhibit characteristic jerky movements with whip-like motions of the flagella and continuous movement of the undulating membrane, but with little or no forward progression "as distinct from the quick darting movements of *T. columbae* of pigeons which progresses forward so rapidly that an individual organism soon passes from the field of vision".

Kofoid (1939) showed that the number of flagella in the flagellar complex of a species and in some instances of a genus, is constant and characteristic, at least in flagellates below the hypermastigotes (protozoa with numerous flagella). He believed that apparent variations are due to the progress of changes preceding binary fission, and that the ultimate result of such fission is a restoration of a typical flagellar complex. He found considerable evidence that, under some conditions, the marginal filament may be torn free and join the group of anterior free flagella, and he suggested that this may have occurred in *Trichomastix gallinarum* Martin and Robertson (1911), making it, therefore, only an aberrant form of *Trichomonas eberthi*. [According to Wenyon (1926—p. 672), the name *Trichomastix* had previously been proposed by Vollenhoevan for an insect and so Kofoid and Swezy (1915) introduced the generic name *Eutrichomastix*.]

Bushnell and Twiehaus (1940), while not committing themselves, considered that, from the evidence available, there are two distinct species, although they did not describe the morphology of the trichomonads found by them in the upper and lower digestive tracts of turkeys.

Trichomonads from the upper and lower digestive tracts of domestic fowls were described by Schaaf and Scherle (1938*b*). The throat form had four anterior flagella and closely resembled *T. gallinarum* Martin and Robertson (1911); the marginal fibril did not continue as a free flagellum but ended at the tip of the undulating membrane. The intestinal form, which was slightly smaller than the throat flagellate, had only three anterior flagella and the marginal fibril was continued as a posterior flagellum.

Florent (1938) stated that chickens were refractory to the pigeon trichomonad and Allen (1940) and Levine, Boley, and Hester (1941) found a similar resistance to the turkey trichomonad. Levine and Brandly (1939) isolated organisms which closely resembled the pigeon trichomonad from lesions of the crop and oesophagus of young pullets. Levine, Boley, and Hester (1941) fed trichomonads, isolated from the upper digestive tract of chickens, to the turkey, bob-white quail, canary, and English sparrow, all of which showed characteristic lesions. A light infection without lesions was produced in one of 11 ducklings, but the ring-necked pheasant and starling were resistant. These authors maintained that there was no significant morphological difference between trichomonads recovered from a variety of avian hosts and, since transmission has been effected by various workers (a) from the pigeon to turkeys, chickens, and hawks, and even to the rat, mouse, and guinea pig; (b) from the turkey to pigeons and chickens; (c) from the chicken to the pigeon, turkey, bob-white quail, canary, English sparrow and, with difficulty, to the duck; and (d) from the Java sparrow to the Tovi parrakeet, Verraux's dove, and chickens, they concluded that all trichomonads from the upper digestive tract of birds belong to one species, *T. gallinae*. They thus regarded *T. hepatica*, *T. columbae*, *T. diversa*, and *T. halli* Yakimoff (1934) as synonyms.

2. Culture

Cailleau (1937*a*), during an extensive study of the growth requirements of pigeon trichomonads, tested various culture media. The only ones that gave satisfactory results were liver to which were added liquids such as distilled water, saline, Locke's solution, broth, or a solution of phosphates, lecithin, and cholesterol; the addition of autolysed yeast was not beneficial. The ratio of liver to fluid was important and the optimum incubation temperature was about 40°C. Cailleau believed that a low pH of 4·5–4·6 was one of the causes of death of the trichomonads, the survival of which was prolonged by the addition of calcium carbonate. The enrichment of broth with calf, pigeon, or rabbit liver, spleen, and heart, rabbit intestinal wall, brain, muscle, pancreas, kidney, adrenal gland, and testicle gave satisfactory growth, but trichomonads would not grow in broth containing the sera of horse, rabbit, man, cat, or sheep, while rat, guinea pig, or fowl serum gave indifferent results. Most favourable growth occurred with pigeon serum. The inability of horse serum to maintain growth was rather curious and was thought to be due to (a) its agglutinating property, and (b) absence of or deficiency in a growth factor. Although pigeon serum also had an agglutinating action, this was only evident at very high titres. The fermentation of sugars closely resembled that of *T. foetus*. At least two growth factors seemed to be present in the liver; one was not soluble in acetone, alcohol, or ether, and was thermostable but of unknown nature; the other, soluble in acetone and alcohol, was cholesterol.

An extensive study of cholesterol and of the activity of numerous sterols as growth factors was reported in a later paper (Cailleau, 1937*b*). Further studies (Cailleau, 1939*a*) showed that this trichomonad would not multiply beyond the first passage in broth to which pigeon serum free of ascorbic acid was added, but reached seven passages after the addition of ascorbic acid ; growth in broth and calf liver (rendered inert by acetone and alcohol and kept for 14 months) was only possible after the addition of ascorbic acid and cholesterol. Spörri (1938) cultured the pigeon trichomonad on Locke's-egg-serum medium, but he could not obtain growth on liver or serum broth.

Hawn (1937) maintained cultures of *T. diversa* on Tyzzer's agar-albumen slants (used for the cultivation of *Histomonas meleagridis*), modified by the addition of Locke's solution containing horse serum and having a final pH of 7·2–7·4. This medium, however, was of doubtful value for cultivation of trichomonads isolated from the lower digestive tract. Cailleau (1939*b*) first isolated trichomonads from the turkey's intestine in horse serum on coagulated egg medium, but optimum development was reached in media consisting of coagulated sheep serum, Locke's solution, rice starch, and egg albumen. Various antibacterial agents were tested and it was found that acriflavine was more toxic for trichomonads than for bacteria, whilst " quinanil " was equally toxic for both ; the flagellates were resistant to large doses of sulphanilamide and di-(*p*-amino-phenyl) sulphone, which did not destroy the bacteria present. Pure cultures were finally obtained by adding " quinanil " 1 : 20,000 to a medium containing sulphanilamide and di-(*p*-amino-phenyl) sulphone. Cultures were obtained in several media, including broth and turkey liver sterilized for 20 minutes at 120°C. Transfers were made up to 12 passages and optimum growth occurred at 40°C. ; growth was irregular at 37°C. and there was none at 35°C. Cultures were also obtained in Kofoid and Wagener's medium. In the broth media, the turkey liver was later replaced by chicken or pigeon liver, but monkey, calf, or rabbit liver was not satisfactory. Further studies (Cailleau, 1940) showed that the nutritive requirements of the turkey trichomonad were similar to those of the pigeon form, except that there was an additional growth factor (not identified), which was not present in old liver broth. The turkey flagellate was grown in a Locke's-egg-(turkey) serum medium, but it was impossible to maintain growth in the absence of ascorbic acid, and even in its presence, growth was poor ; it was, however, a necessary factor for multiplication. Levine and Brandly (1939 and 1940) maintained trichomonads, isolated from fowls, on Ringer's-egg-serum-glucose media.

3. Pathogenesis and Treatment in Pigeons

The commonest and most dangerous form of the disease is known as " yellow button " ; it affects young birds of 10–25 days old and is frequently restricted to the progeny of affected parents (Oehlkers, 1937). Schaaf (1937) described these " yellow button " lesions in the throat, oesophagus, and crop and he also observed necrosis of the liver, lungs, and pancreas, as well as enteritis, pericarditis, and pleurisy. Schaaf was doubtful whether trichomonads were the primary cause or whether their action was dependent upon bacterial invasion, for trichomonads and various bacteria have been isolated from diseased birds, and he also found trichomonads on the mucous membrane of the upper digestive tract of healthy birds. Spörri (1938) observed pericardial thickening with greyish yellow fibrinous deposits, and greyish mucus in the mouth of infected pigeons 3–5 months old ; there was also diffuse reddening of the mucous membrane of the crop, and enlargement of the liver in which there were yellowish grey necrotic areas of variable size. Spörri considered that the liver form was much more serious than the " yellow button " form and pointed out the similarity of the liver lesions to those of blackhead. Florent (1938) stated that pigeons became infected either indirectly by contamination of the water supply or directly by ingestion, and that, although young pigeons were first attacked, the disease might later spread to older birds. He found that the virulence of the organisms varied enormously and that many pigeons might be carriers of saprophytic strains. He isolated trichomonads from the necrotic lesions in the mouth and from the faeces during life, and from the blood, spleen, and bone marrow after death. Niemeyer (1939) reported an outbreak of trichomoniasis and *Salmonella typhi-murium* infection in pigeons in California. He found large numbers of trichomonads in the mouth, sinuses, trachea, oesophagus, and crop ; *Hexamita* was also present in the small intestine and bursa of Fabricius. Material, rich in flagellates, from an infected squab was fed to a six-week-old pullet ; trichomonads were present in the mouth of the pullet ten days later, but none was present 25 days after administration. Infective material from two other diseased squabs was then fed to two normal eight-week-old pigeons, both of which remained healthy until they were destroyed eight weeks later, when trichomonads were found in the upper respiratory and digestive tracts. In one case, small necrotic lesions were seen in the liver but no trichomonads were isolated. Similar inoculations were made into four other three-month-old pigeons and, 25 days later, one had died, one was emaciated, and the other two appeared normal. The dead squab showed an enlarged, friable liver and spleen with yellowish-coloured exudate over the surfaces ; the cardiac muscle was flaccid and the pericardial sac was distended with fluid ; the abdominal air sacs, the walls of which were thickened, were filled with a purulent exudate ; greyish-coloured tenacious exudate and canker were present in the mouth and crop, and the liver showed a few small, grey areas on the surface. No trichomonads were found in the clinically normal birds, although one had suspicious liver lesions.

To treat the disease, Miessner and Hansen (1936) used, for disinfection of the drinking water, 0·5% " sulpholiquid " and 0·5% copper sulphate. Spörri (1938) also recommended the latter agent, replaced five days later by 0·5% corrosive sublimate. Kraneveld and Nasoetion (1940) reported good results in the Dutch East Indies from the use of sulphanilamide, either by single injection or by injection repeated three times on alternate days of 0·5 ml. of a 10% suspension directly into the necrotic lesions, or by intramuscular injection of the same dose repeated two or three times on alternate days ; oral administration was less satisfactory. Treatment of fibrinous diphtheritic lesions by the daily dropping on of 0·5 ml. of 10% suspension or by painting with sulphanilamide paste in an equal quantity of distilled water led to complete cure in 80–100% of cases. Injection of the same amount of suspension into the breast muscles on three alternate days cured 90–100% of cases. Diphtheritic fibrinous lesions were more difficult to influence than submucous necrotic lesions, and trichomonads were sometimes demonstrable in the throat of birds with the former lesions for long periods of time after apparent recovery, although relapses were never observed after treatment had resulted in clinical cure. Bos (1941) recommended painting affected areas with 0·5–1·0% trypaflavine solution for the elimination of carriers, but this treatment was of no value for clinical cases.

Control by the elimination or treatment of carriers, and by the hatching of eggs and feeding of squabs by healthy birds was suggested by Oehlkers (1937).

4. Pathogenesis and Treatment in Turkeys

Hawn (1937) estimated, from field reports, that losses in mature flocks were usually slight, although death rates from 73% in mature flocks to 87% in young flocks had been encountered. Most cases occurred from late autumn to early spring and he found that adult turkeys were more often affected than poults, possibly due to the practice of rearing young birds on clean ground where there was little contact with adults. He also found that birds which showed a retention of fluid in the crop and symptoms of depression usually died and that, although poults might die within 24 hours after the onset of symptoms, older birds usually lived several days. Most mature birds had a partial or complete occlusion of the posterior oesophagus due to the large necrotic lesions. Bushnell and Twiehaus (1940) reported the following clinical picture. Drowsiness and great depression in young poults, which stand or sit with eyes closed and head hanging so low that the beak may rest on the ground; when handled they may appear active, but at rest they soon adopt the position described. This is accompanied by sagging wings, lack of appetite, and emaciation; the droppings are watery in consistency and teem with parasites. In older birds, the crop area usually appears depressed or sunken and sometimes pendulous; the mouth odour is putrid and, although characteristic, is not diagnostic; just prior to death there are repeated attempts at deglutition; at death there is often an extension of the head and neck. The lesions consist of small white or yellowish nodules on the mucous membrane of the mouth, oesophagus, and crop; in the last site the infected mucous glands may contain a semi-caseous material and are surrounded by a ring of exudate; the centres of the lesions may be raised and ulcers may be so numerous as to coalesce and even penetrate the submucosa and perforate the wall. In acute cases there may be oedema of the surrounding tissues; in advanced cases the mucous membrane of the proventriculus may show necrosis, and is usually covered with a thick, diffuse layer of semi-gelatinous mucus and exudes a sour, putrid odour; the gizzard is not involved, but the crop contains what is described as "a viscid, colourless or cloudy, watery, mucous fluid filled with dirty white flakes, bacteria, and trichomonads".

These authors also described a condition in the lower digestive tract, of catarrhal enteritis in which the lower intestine and caeca are thin-walled and lacking in tone and their contents are semi-fluid and contain gas bubbles and large numbers of flagellates. Allen (1940) found an acute type of the disease in young turkeys similar to that encountered in chickens, except that the mortality rate was higher in poults; in adult turkeys with a chronic infection a severe enterohepatitis, which was usually fatal, was often encountered. Allen and Olsen (1942) found that young poults, which survived the acute phase, developed a chronic form, from which they might die at three months or more of age. They observed a mortality rate of 0–44%. The chronic type was characterized by intermittent diarrhoea occurring almost invariably in cool, rainy weather. The temperature, after an initial rise from 106° to 109°F., later became subnormal. Death was not the only source of loss, for the average weight of survivors was much lower than normal and the feeding of unthrifty turkeys was uneconomical.

Allen (1941) fed pure cultures of turkey trichomonads and *Histomonas meleagridis* to young poults and compared the macroscopic liver lesions produced. Trichomonad lesions were irregular in outline, of granular appearance, and level or slightly elevated above the liver surface, whereas histomonad lesions were more or less circular, with narrow distinct borders enclosing web-like formations of necrotic material, and were slightly depressed below the liver surface. Allen also found that liver lesions associated with natural mixed infections of turkey trichomonads and *H. meleagridis* were relatively larger, circular, markedly depressed with slightly raised granular borders and sometimes having granules scattered in the centre as well as at the edges; such lesions were not seen in very young birds. Allen concluded that frequently these findings have been regarded as being associated with a pure histomonad infection.

In order to establish the pathogenicity of turkey trichomonads, Hawn (1937) inoculated 35 turkeys, mostly adults, in various ways with an unfiltered suspension of infected tissues. Of these birds, 15 revealed gross lesions at autopsy, and 20 apparently were not infected. In addition, 15 adult chickens, six pigeons, and six sparrows were fed tissue suspensions with and without scarification of the oesophagus, but none developed typical lesions. Of 56 turkeys fed, without damage to the oesophageal mucosa, on cultures of *T. diversa* contaminated with bacteria, 30 developed typical lesions and 14 of these showed symptoms. When 50 of these turkeys were examined for trichomonads in the upper digestive tract, 43 were positive and six were negative both for flagellates and lesions; 14 were negative for lesions but positive for trichomonads. Examination of 41 turkeys for trichomonads in the duodenum and caeca showed four and three respectively to be positive. When *T. diversa* was found in the duodenum or caeca, it was also found in the upper digestive tract, which was probably the primary site of infection, but there was no evidence that *T. diversa* produced gross lesions in the lower digestive tract. Inoculation of turkeys with dead trichomonad cultures failed to produce the disease, but infection was produced with cultures of *T. diversa* isolated from carriers. Hawn concluded that bacteria had no direct influence upon the pathogenesis of the disease. Allen (1941) fed trichomonads, isolated from liver lesions of turkeys, to 75 seven-day-old poults, and ten birds developed trichomoniasis when between the ages of three and seven months.

In contrast to these records, Hinshaw and McNeil (1942) maintained that infectious catarrhal enteritis of turkeys, generally considered to be a trichomoniasis, is caused by *Hexamita meleagridis*. They considered that the "two species" of *Trichomonas* found in the lower intestinal tract of turkeys are not pathogenic and, therefore, the term "trichomoniasis" should not be applied to this disease.

For control, Hawn (1937) recommended the common practice of artificial incubation and rearing followed by isolation of the young poults in clean surroundings, and the separation of poults from adults, which may remain carriers for a considerable time.

Bushnell and Twiehaus (1940) summarized the drug treatments that have been recommended. They are:– ipecacuanha and catechu (1 : 4) mixed with the food or water; a watery solution of iodine added to milk; sulphur in the mash; copper sulphate in the drinking water; acriflavine solution; and calomel.

Knight, McDougle, and Durant (1942) found that turkeys affected with trichomoniasis of the caeca and liver had a marked deficiency of vitamin A, and that birds fed on a high vitamin A diet showed considerable resistance to infection. To help control the disease,

they recommend feeding a mash comprising ground oats, yeast, and cod liver oil. The addition of alfalfa leaf meal is said to increase the palatability of the fermented mash. Treatment of individuals includes the administration of gentian violet either in the form of a tablet or as a solution.

David (1928) recommended dosing affected poults with 1% antimony tartrate solution.

Any treatment has, of course, to be combined with proper hygienic measures, especially the removal of all wet and decomposing straw.

Fever therapy was used by Olsen and Allen (1940) for treatment of turkeys naturally infected with trichomoniasis of the lower digestive tract. The birds, 3–18 months old, were placed in a thermostatically controlled cabinet for 1–2 hours. The internal body temperature was raised 2°–6°F. above the normal of 106·5°F. by maintaining an air temperature in the cabinet of 104°F. and a relative humidity of 60–70%. Usually three treatments, given every other day, were sufficient, but in a few severe cases as many as six were required to check the disease. After treatment the birds were placed in wire-bottomed cages at room temperature. When 24 birds were so treated, 20 recovered, and of the four which failed to respond, two died during or shortly after the first treatment.

5. Pathogenesis in Domestic Fowls

In contrast to the condition in pigeons, Schaaf and Scherle (1938*a*) noted that trichomonads were rarely found on the mucosa of the upper digestive tract of healthy fowls (in only 0·2% of birds examined), whereas in birds with colds the same trichomonad was demonstrable in the throat in 3·2% of cases. Trichomonads were, however, found in the caeca of about 50% of healthy birds ; in about 58% of these the same flagellate as that found in various enteritic conditions such as coccidiosis, intestinal tuberculosis, etc. was observed. In neither young nor old birds could trichomonads be incriminated as a sole cause of enteritis. Further studies (Schaaf and Scherle, 1938*c*) revealed that, after artificial inoculation, trichomonads remained only a few days on healthy mucosa. When inoculated into the throat mucosa of fowls with colds or fowl pox, the trichomonads multiplied, although not as plentifully nor for as long a time in the case of birds with colds. Schaaf and Scherle thus concluded that these trichomonads occurred as harmless commensals and might invade diphtheroid lesions as secondary invaders. Conditions suitable to support trichomonads did not appear to be present in the mucosa of normal throats and crops and the authors regarded as saprophytes the trichomonads which were frequently present in the caeca.

On the other hand, Levine and Brandly (1939) reported a disease of the crop and oesophagus in young pullets, associated with trichomonads. Many of the dead birds exhibited a variety of intercurrent diseases, but the dry, caseous, multiple foci appeared to be very similar, although smaller, to trichomonad lesions of turkeys and pigeons. Attempts to transmit the infection to turkeys, pullets, baby chicks, and pigeons were unsuccessful except in the case of one pigeon. Later, Levine and Brandly (1940) fed trichomonads, isolated from the first outbreak, to chicks 2–5 days old. Some birds were very resistant and could only be infected by feeding after scarification of the oesophagus, yet others, obtained from a different source, were readily infected, even without previous laceration of the oesophagus. Levine and Brandly concluded that, although chickens were relatively resistant to trichomoniasis of the upper digestive tract, individual differences in resistance and the presence of intercurrent disease might allow these parasites to become pathogenic.

Sforza (1939), however, who isolated trichomonads from necrotic lesions of the liver and caeca of fowls, was able to transmit the disease by feeding liver emulsions. Allen (1940) stated that chickens frequently carried the trichomonad of the lower intestine of turkeys, but that it was rarely pathogenic. Occasionally, however, very young chickens developed an acute attack associated with caecal diarrhoea and sometimes death, and, rarely, adult fowls developed a chronic enterohepatitis which might also prove fatal.

That the caeca are the normal site of infection in fowls was concluded by Richardson (1939), who found that caecectomized chickens did not become infected with *Trichomonas* or *Chilomastix* when placed in contact with parasitized birds or when fed material containing these organisms.

The lesions associated with disease of the upper digestive tract were studied by Bushnell (1942), who observed that they closely resembled those in pigeons. The characteristic lesions were found mainly in the crop and primarily consisted of semi-caseous yellowish grey nodules in the mucous glands. Similar lesions were found to occur later in the posterior part of the oral cavity, while the mucous membrane of the anterior parts of the proventriculus sometimes showed sloughing. The location of the lesions was said to vary to some extent in different hosts and there was some evidence that the flagellates might invade the liver, lungs, and other tissues, giving rise to lesions similar to those of blackhead.

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(1) " **Antibacterial Agents derived from Micro-Organisms** ".

(2) " **The Present Position of Phenothiazine as an Anthelmintic** ".

(3) " **Trichomoniasis—A Review of Recent Literature** ".

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DISEASES CAUSED BY BACTERIA AND FUNGI

FISK, R. T. (1942). **Studies on Staphylococci. I. Occurrence of Bacteriophage Carriers among Strains of Staphylococcus aureus. II. Identification of Staphylococcus aureus by Means of Bacteriophage.** —*J. infect. Dis.* **71.** 153–160 & 161–165. **718**

I. 44·2% of 43 strains of *Staph. aureus* were found to be lysogenic, glucose-agar plates being used as a medium for their detection. Liquid media were found unsuitable for the detection of bacteriophage-carrying strains; plaques were demonstrated by growing lysogenic strains in combination with susceptible indicator strains. No lysogenic strains were found in 22 strains of coagulase-negative haemolytic staphylococci and these strains were resistant to the phages isolated from coagulase-positive haemolytic staphylococci. Twenty-four different phages were isolated; these showed a high degree of strain specificity.

II. Ninety-five strains of *Staph. aureus* were tested with 27 different bacteriophages isolated from strains of this organism. It was found possible to divide strains of staphylococci into groups dependent on the combination of phages to which they were susceptible. Strains isolated from similar sources reacted with the same phages.—D. L. ROBARTS.

MILLER, W. T., & HEISHMAN, J. O. (1943). **Staphylococcal Antitoxin in the Blood, Milk, and Colostrum of Cows.**—*Amer. J. vet. Res.* **4.** 265–269. **719**

Less than ½ unit of circulating antitoxin was found in the blood of 25·9% of the cows examined, 4 units were found in 67·4%, and a range of 5–64 in the remaining 53 animals. Antitoxin was found in the normal milk of only one-sixth of the animals examined; of these all had appreciable serum titres. Two cows with acute mastitis were shown to have 16–32 units in the affected quarters. Colostrum was shown to contain appreciable amounts of antitoxin approaching and even exceeding the titre in the blood. The antitoxin rapidly disappeared as the secretion changed from colostrum to milk. It is deduced that the appearance of staphylococcal antitoxin in the blood, except possibly in high titres, cannot be taken as evidence of udder infection.

Pointing out that it has been observed that staphylococci have persisted in quarters where appreciable quantities of antitoxin have been demonstrated during the dry period, the authors suggest that there may be some doubt as to the value of using toxoid in the treatment of staphylococcal infections of the udder.—J. M. P.

MOREIRA-JACOB, M. (1942). Nótula àcêrca dos caractéres diferenciais do "Streptococcus agalactiae" e germes afins. [**Differentiation of** *Str. agalactiae*].—*Bol. pec., Lisboa.* **10.** Reprint pp. 3. **720**

The author examined 350 strains of mastitis streptococci for final pH in dextrose broth, reaction in litmus milk and methylene blue milk, hydrolysis of sodium hippurate, fermentation of carbohydrates, and, in some cases, for Lancefield grouping. He concludes that *Str. agalactiae* strains form a homogeneous and well-defined group, that *Str. uberis* strains form an ill-defined group and are sometimes difficult to distinguish from *Str. faecalis*, and that haemolysis is of no value in the differentiation of bovine mastitis streptococci.—ISOBEL W. BURTON.

MOREIRA-JACOB, M. (1942). A mastite bovina na ilha da Madeira. [**Bovine Mastitis in Madeira**].—*Bol. pec., Lisboa.* **10.** Reprint pp. 8. [English and French summaries]. **721**

Clinical, chemical, and bacteriological examinations were made of milk samples from 202 cows; of 123 samples from suspicious quarters, 17 were infected with *Streptococcus agalactiae* and two with staphylococci.
—MILLER WATSON.

*BOZZELLI, R., & RANDO, D. (1941). Sull'infezione carbonchiosa per via mammaria. Contributo allo studio della patogenesi del carbonchio ematico.—[**Anthrax Infection** *via* **the Udder in Goats**].—*Boll. Ist. sieroter. Milano.* **20.** 19–30. [Abst. from abst. in *Zbl. Bakt. I.* (*Ref.*). **142.** 481]. **722**

Two goats were infected by the inoculation of virulent anthrax material into the udder.—A. R. J.

*VELU, H., SOULIE, P., & COURTADE, R. (1941). Charbon pulmonaire expérimental de la souris à porte d'entrée intestinale. [**Experimental Pulmonary Anthrax in Mice Infected Intestinally**].—*C. R. Soc. Biol. Paris.* **135.** 1354–1355. [Abst. from abst. in *Zbl. Bakt. I.* (*Ref.*). **142.** 481]. **723**

Mice were exposed to anthrax infection *via* the alimentary tract and later made to inhale small amounts of chlorine, which produced no clinical symptoms: anthrax spores were then demonstrated in the lungs.
—A. R. JENNINGS.

SWEANY, H. C. (1942). **Age Characteristics of Tubercles.** —*Amer. Rev. Tuberc.* **46.** 329–345. [Spanish summary]. **724**

The phenomenon of primary tubercle formation in man was studied under several divisions in a chronological sequence, namely, acute inflammatory reaction. degeneration of focal cells, encapsulation and sterilization of the debris, and disintegration and resorption of the sterile mass. Most primary tubercles soon become sterile and regressive and the rate of these changes is sufficiently constant to be used as age markings in most cases. Factors modifying this age analysis, *e.g.* "overflowing lesions", satellite foci, reinfection lesions, and "reinfection complexes", and other special types of lesions, are discussed with illustrations, and means of investigating them are suggested. Detailed clinical, X-ray, and laboratory data are required for this study.

This age morphology of tubercles may be useful in observing the progression of TB. in the body.

—D. N. SPRIGGS.

ORNSTEIN, G. G. (1941). **Hematogenous Dissemination of Tubercle Bacilli in Primary and Reinfection Forms of Tuberculosis.**—*Quart. Bull. Sea View Hosp.* **6.** 343–362. **725**

The author cites evidence from the literature and also from his own experience which does not support the view that primary infection in TB. is a purely local process. Subcutaneous injection of tubercle bacilli into g. pigs is followed by rapid dissemination: tubercle bacilli can be demonstrated in the spleen and various lymph nodes remote from the site of inoculation after only four days. The work of A. S. and F. GRIFFITH showed that in animals dissemination of tubercle bacilli could occur within 24 hours and was independent of the virulence of the strain for the animal concerned. In man it is probable that tubercle bacilli spread from the primary focus to distant organs within the first few days; this dissemination occurs during the period before allergy to tuberculoproteins has developed, sensitization in man requiring 14 days to four months for its development. Once allergy has been established, spread along lymphatic channels no longer occurs and it is generally agreed that the lymph nodes are not infected during the reinfection period of TB.

It is important to realize the widespread dissemination of tubercle bacilli occurring during the pre-allergic (primary infection) stage and their distribution to various organs and tissues by the lymphatics and venous and arterial circulations. This spread is largely brought about by reticulo-endothelial cells which have engulfed tubercle bacilli and which convey them through the circulatory system. During the allergic stage, there is no lymphatic spread and haematogenous infection can occur only by direct invasion of blood or lymphatic vessels from caseous tuberculous lesions. Reticulo-endothelial cells play no part in the dissemination.

It is suggested that the terms "primary infection" and "reinfection" as applied to the stages of the tuberculous process should be replaced by "pre-allergic phase" and "allergic phase" respectively.

—E. G. WHITE.

KAYNE, G. G. (1943). **Immunity to Tuberculosis.**—*Brit. med. J.* June 26th. 777–779. [See also abst. 794]. **726**

Those engaged in studying this problem have not yet reached agreement on the exact nature of the mechanisms involved in humoral and cellular resistance to TB. At one time it was believed that the high susceptibility of adult negroes to TB. was due to the fact that they had not been exposed to infection in childhood and therefore had no healed primary complex. K. shows that this facile explanation is incorrect; the susceptibility of the negro is due to his inability to develop an acquired resistance, following primary infection, which would alter the character of reinfection lesions. In the same way, LURIE (1928) has shown that in the first week after inoculation in the rabbit, human type tubercle bacilli multiply even more rapidly than the bovine type organisms. The rabbit, however, soon develops a resistance to the human type tubercle bacilli, but not to the bovine which continue to multiply in the lungs and kidney.

Speaking generally, K. considers that the following degrees of resistance to TB. may be recognized. The lowest degree of natural resistance will not, on first contact with the bacillus, prevent an extensive primary complex with rapid generalization and death. A higher degree of natural resistance will lead to a primary complex with perhaps some dissemination, and recovery, but no acquired resistance will follow; so that, as is often the case with negroes and South African natives, a fresh infection under bad environmental conditions will again result in a primary complex, this time with generalization and death. A still higher degree of natural resistance will cause a primary complex, recovery from which will give acquired resistance; and therefore any subsequent reinfection will not produce a primary complex but a parenchymatous lesion which tends to liquefy, cavitate, and spread by the bronchi.

The work of RICH (1936) and of PAGEL (1937) showing that hypersensitivity and immunity are not necessarily associated and can be demonstrated as distinct phenomena, is quoted. Authorities are not agreed about the relative importance of cellular and humoral immunity in TB.—JOHN FRANCIS.

WILKINSON, M. C., & CURETON, R. J. R. (1943). **Relation of the Lymphatic Glands to Immunity against Tuberculosis.**—*Lancet.* **245.** 662–663. **727**

Clinical evidence is quoted supporting the thesis that the lymphatic barrier to the invasion of the bloodstream by tubercle bacilli is most effective in childhood and less so in infancy and maturity (a finding related to the fact that lymphoid tissue in man reaches its maximum development about the 12th year and then becomes less), and data, derived from a study of 400 sanitorium patients, mostly children, suffering from TB. of the cervical, thoracic, or abdominal lymph nodes, are presented indicating that those who develop some degree of tuberculous lymphadenitis also develop a certain degree of immunity to TB. Literature is quoted relating to primary infection of adults and the conclusion is drawn that immunity against TB. can best be achieved during childhood, this being the age at which active immunization procedures are most likely to prove successful.—J. LOCHIEL MCGIRR.

FRAENKEL, E. (1943). **Significance of the Massive Dose in Tubercular Infection.**—*Tubercle, Lond.* **24.** 85–88. **728**

The special role of exposure to massive doses of tubercle bacilli in the aetiology of human TB. is discussed. It is concluded that preventive measures based on the isolation of susceptible individuals from exposure to such doses are not unrational.—R. S. DE ROPP.

*VANNFÄLT, K. A. (1942). Jämförande undersökning mellan ympning av marsvin och odling på substrat enligt Hohn eller Löwenstein för påvisande av tuberkelbaciller. **[Comparison of G. Pig Inoculation and Culture on Hohn's or Löwenstein's Media in TB. Diagnosis].**—*Nord. Med.* No. 6–13. p.957. [Abst. from abst. in *Skand. VetTidskr.* **32.** 772. **729**

Tubercle bacilli were demonstrated in 20·6% of 175 samples of sputum, etc. by g. pig inoculation and in 26·3% by culture [not clearly stated in abst. whether both media were used in every case; it is, however, stated that each medium was equally reliable]. The cultural method is more rapid and is cheaper than the inoculation method.—J. E.

MAXWELL, H. (1943). **The Occurrence, in Cattle, of Abortion, Macerated Fetuses, and Acute Suppurative Mastitis, Associated with** *Corynebacterium pyogenes.* —*Cornell Vet.* **33.** 315–318. **730**

This is a case report of an outbreak of abortion occurring in a herd of about 15 animals. Seven cows aborted after 3–8 months' pregnancy. There were two cases of macerated foetuses and one of pyometra. No uterine material was examined bacteriologically. Among the remainder of the herd there were two cases of purulent mastitis from which *Corynebact. pyogenes* was isolated in practically pure culture.

Only one live calf was delivered during the outbreak, and this died when four weeks old ; *Corynebact. pyogenes* was recovered from the lungs and kidneys.

All the herd was negative to the agglutination test for brucella. The herd sire and the two mastitis cows were negative to *Trichomonas foetus* on one individual microscopic examination ; thus the absence of this disease was not definitely proved.—J. E. LANCASTER.

MOREIRA-JACOB, M. (1942). Nótula sôbre em caso de mamite por "Corynebacterium pyogenes" em Portugal. [**Case of Mastitis caused by** *Corynebact. pyogenes* **in Portugal**].—*Bol. pec., Lisboa.* **10.** Reprint pp. 2. **731**

This is said to be the first recorded case in Portugal of bovine mastitis caused by *Corynebact. pyogenes.* The apparent portal of entry of infection was a traumatized teat.—MILLER WATSON.

SPENCER, W. T. (1943). **Swine Erysipelas a Menace to Production.**—*J. Amer. vet. med. Ass.* **102.** 187–189. **732**

S. states that the rapid increase in pig population will probably lead to overcrowding and bad management, as many persons with little experience will attempt to raise pigs. Unless intelligent control methods are adopted, he expects that swine erysipelas will take a heavy toll.

The aetiology, symptoms, P.M. lesions, prevention, and control of the disease are briefly discussed. Vaccination is advised by the serum-culture method of all pigs 1–10 days old, on farms where the disease has been present. Traffic in pigs as a factor in the spread of disease is emphasized. It is recommended that pigs passing through markets should receive a dose of swine erysipelas serum.—T. M. DOCKER.

LITTLE, P. A., & LYON, B. M. (1943). **Demonstration of Serological Types Within the Nonhemolytic Pasteurella.**—*Amer. J. vet. Res.* **4.** 110–112. **733**

Of 30 strains of non-haemolytic pasteurella studied, 12 were classified as type 1, 11 as type 2, and seven as type 3. The type differentiation was made using rapid slide agglutination tests with monovalent sera prepared in rabbits. The origins of the strains were :– type 1—avian (4), bovine (1), equine (4), and porcine (3) ; type 2—buffalo (8), avian (1), bovine (1), and rabbit (1) ; type 3—avian (1), canine (2), ovine (1), porcine (1), and mouse (1). The specificity of each of the 3 types was demonstrated by mouse-protection tests. Similar specific results, using serum from immune horses, suggest that pasteurella bacterins and antisera might usefully be made trivalent.—E. COTCHIN.

FRANCIS, E. (1943). **Twenty-year Survival of Virulent** *Bacillus pestis* **Cultures without Transfer.**—*Publ. Hlth. Rep., Wash.* **58.** 1379–1382. [Author's conclusion copied *verbatim*]. **734**

Bacillus [*Pasteurella*] *pestis* retained viability and virulence for 10 to 20 years on slants of beef infusion agar stored at approximately 10°C. without transfer.

SPECK, M. L., & STARK, C. N. (1942). **The Gas Ratio and some Correlated Distinguishing Properties of Bacteria of the Genus Proteus.**—*J. Bact.* **44.** 687–701. **735**

Sixty-six recently isolated, and 42 old cultures of organisms of the genus *Proteus* were studied. The former were obtained mainly from sewage and putrefying meat, and the latter had been grown on laboratory media for years. The gases produced in glucose peptone water were collected and the $CO_2 : H_2$ ratio for each organism was determined. The effects were studied of two different brands of peptone, and of the concentration of sugar in the media, on the total gas and gas ratio. Grown under anaerobic conditions, it was found that the 108 strains of organisms belonging to the genus *Proteus* fell into three main groups on the basis of the gas ratio. The organisms in each group tended to be correlated as regards indole formation, citrate utilization, and production of acetylmethylcarbinol, but between the fresh and the old cultures there was a considerable variation in the ability to ferment certain carbohydrates. Whereas all the fresh cultures fermented maltose, and all but three fermented mannite, ten old cultures failed to ferment maltose and only two fermented mannite. It is suggested that the classification of the genus *Proteus* should be based on stable properties such as gas ratio, and that the names *P. hydrophilus*, *P. mirabilis*, and *P. vulgaris* be given to the high ratio, medium ratio, and low ratio groups respectively.—T. M. DOCKER.

STUART, C. A., & RUSTIGIAN, R. (1943). **Further Studies on the Eijkman Reactions of Shigella Cultures.**—*J. Bact.* **46.** 105–107. **736**

As it has been found that the reduction of trimethylamine oxide by *Shigella* species corresponds to their Eijkman reactions, the authors tested 276 cultures and found that for diagnostic work (where adequate antisera are not available) either the Eijkman or the trimethylamine test can be used to advantage.—J. M. PETERS.

STUART, C. A., WHEELER, K. M., RUSTIGIAN, R., & ZIMMERMAN, A. (1943). **Biochemical and Antigenic Relationships of the Paracolon Bacteria.**—*J. Bact.* **45.** 101–119. **737**

From a study of the biochemical and serological relationships of 465 strains of human paracolon bacilli to one another and to normal coliforms and salmonella, the authors conclude that, although usually regarded as aberrant coliform organisms, the bacilli could be classified as belonging to a distinct biological group of bacteria. Physiological specialization was found to proceed independently within the *Aerobacter*, intermediate and *Escherichia* sections of the paracolon group, warranting their being regarded as intermediate between normal coliforms and salmonella. Serological typing of the strains belonging to the three sections, by testing them against the respective paracolon antisera, showed that much larger proportions of each section were identical or closely related than was the case for the normal *Aerobacter*, intermediate and *Escherichia* strains. Known and unidentified salmonella somatic antigens were frequently encountered in all sections of normal coliform and paracolon groups.

Geographical segregation within the paracolon group was suggested by the fact that strains from one locality, while frequently identical with other cultures from the same, were seldom identical with strains from different localities. The complex serological structure of paracolon bacteria made their classification on the basis of H and O antigens impracticable. With both serological and physiological properties, there appeared to be no sharp distinction between normal coliform, paracolon and salmonella groups, but rather a more or less continuous series of types.

Although a few types gave some indication of pathogenic properties, the pathogenicity of the paracolon bacteria remained unestablished.—R. O. MUIR.

BORNSTEIN, S. (1943). **The State of the Salmonella Problem.**—*J. Immunol.* **46.** 439–496. **738**

This is a review of the question. B. mentions the use of dark-field cinematography and the electron microscope in the study of *Salmonella.*

He discusses chemotherapy, vaccination, the epidemiology of salmonella infections in North America,

and the control of infection. A list of 378 references is given.—M. L. Levi.

Ward, W. E. (1943). **Protective Action of Vi Bacteriophage in *Eberthella typhi* Infections in Mice.**—*J. infect. Dis.* **72.** 172–176. **739**

In experiments involving 452 mice infected with five different types of *Salmonella typhi* cultures in varying doses, 90% were protected by inoculation, two hours after infection, of an excess of specific bacteriophage. It was shown that to obtain maximum protection, phage inoculation must not be delayed more than four hours after infection. There was an increase in concentration of specific bacteriophage in the heart blood, reaching a peak after five hours, with detectable phage present after 60 hours. Treated mice were healthy carriers of the infecting *S. typhi* for about one month after infection. To show that the action was not due to non-specific shock therapy, 30 infected mice were inoculated with heated broth culture supernatant; all died. Mice inoculated with *S. typhi* and treated with a non-specific bacteriophage showed 93% mortality. Fifty infected mice treated with graded doses of heat-killed *S. typhi* were said to show a mortality of 91%, while 50 infected mice not given heat-killed typhoid bacteria all died. Other experiments indicated the relation of phage concentration to mouse protection, and it was also shown that phage protective action is not due to stimulation of phagocytosis.—T. M. Docker.

Nóbrega, P., & Bueno, R. C. (1942). Sobre a presença da "Salmonella gallinarum" nos ovos de galinhas portadoras de tifo aviário. [**Presence of *S. gallinarum* in Eggs of Fowl Typhoid Carrier Hens**].—*Arq. Inst. Biol., S. Paulo.* **13.** 17–20. [English summary]. **740**

S. gallinarum was found in 29 (1·97%) of 1,465 fresh, non-fertile eggs, laid by fowls giving a positive reaction to the agglutination test for *S. pullorum* infection.—Isobel W. Burton.

Molinelli, E. A. (1942). **A Survey of Brucellosis in the Argentine Republic. Part I: Introduction.**—*Proc. 6th Pacific Sci. Congr., 1939.* **5.** 267–269. **741**

Molinelli, E. A., Basso, G., & Miyara, S. (1942). **A Survey of Brucellosis in the Argentine Republic. Part II: Clinical Study.**—*Ibid.* 270–275. **742**

Ithurrat, E. M. F., Ithurrat, M. C. F., & Molinelli, E. A. (1942). **A Survey of Brucellosis in the Argentine Republic. Part III: Biological Diagnosis.**—*Ibid.* 275–282. **743**

Molinelli, E. A., Basso, G., & Miyara, S. (1942). **Survey of Brucellosis in the Argentine Republic. Part IV: Confrontation between Autocthonous Cases of the Western and Littoral Regions.**—*Ibid.* 282. **744**

Molinelli, E. A., Ithurrat, E. M. F., & Ithurrat, M. C. F. (1942). **Survey of Brucellosis in the Argentine Republic. Part V: Occupational Brucellosis.**—*Ibid.* 283–291. **745**

I. The first case of human brucellosis in the Argentine Republic was diagnosed in 1922. 140–240 cases occurred annually between 1931 and 1938. Caprine, bovine, and porcine infection exists practically throughout the country north of latitude 41°; and the geographical incidence is shown on a map. In the mountainous region, goats are the chief source of human infection, and in the plains pigs and cattle.

II. A general account of the symptomatology of the disease; reference is made to infection with *Br. abortus*, *Br. melitensis*, and *Br. suis*.

III. 195 *Br. suis* strains were isolated from 67 patients, 97 *Br. abortus* from 60 patients, and 294 *Br. melitensis* strains from 194 cases. The authors discuss diagnosis in general and the results obtained with the agglutination, complement-fixation, opsonocytophagic, and intradermal tests.

IV. In the mountainous regions where infection occurs with *Br. melitensis*, the disease is more serious than in the littoral zone where *Br. abortus* and *Br. suis* are the chief causes.

V. Positive reactions to tests were obtained from veterinarians, laboratory personnel, abattoir and meat-packing-plant workers, butchers, milkmen, cattle and goat herdsmen, as well as clerical workers having no direct contact with animals. Statistics are given which show (a) that from 1931–34 there were 118 cases amongst veterinarians; (b) that the higher percentages of infection were amongst workers with long-standing contact with potentially infected animals, and it is suggested that the infection has existed in the Argentine undetected for a long time; (c) that 75% of cases in five great towns were due to infection among workers in abattoirs and meat-packing plants.—A. C. Jonas.

Moreira-Jacob, M. (1942). A brucelose na ilha da Madeira. [**Brucellosis in Madeira**].—*Bol. pec., Lisboa.* **10.** Reprint pp. 9. [English and French summaries]. **746**

The author carried out the agglutination test for brucellosis on 534 samples of serum. The sera included 405 samples from cattle, 119 from pigs, seven from sheep, and three from goats. Six samples gave positive reactions (four pigs and two cows). It is stated that "clinical brucellosis" has not so far been reported in animals or human beings in Madeira. Abortions do, however, occur in cattle and pigs, but seldom recur in the same animal.—Miller Watson.

Tropa, E. A. (1939). Do diagnóstico hemo-sorológico e alérgico das bruceloses bovina e caprina. [**Serological and Allergic Diagnosis of Bovine and Caprine Brucellosis**]. pp. 131. Oporto: Imprensa Portuguesa. [French summary]. **747**

T. carried out complement-fixation and agglutination tests on cattle and goats in an area known to be affected with brucellosis. He compared the antigen prepared at Oporto with those prepared in Lisbon and Evora and also with antigens of foreign origin, including that prepared by the Royal Veterinary College, London. He stressed the need for the standardization of antigens and of the "infected titre". He favoured the use of both tests in doubtful cases.

The preparation is described of a brucellin which T. found useful in allergic diagnosis. He claimed that its use gave a very satisfactory indication of the number of infected animals in a herd.—Miller Watson.

Seelemann, M., & Langeloh, L. (1942). Standardisierung der Untersuchungsmethodik zur serologischen Feststellung der Abortus-Bang-Infektion des Rindes. II. Die Untersuchung der Milch. [**Standardization of Technique for the Serological Diagnosis of Bovine Brucellosis. II. Examination of Milk**].—*Arch. wiss. prakt. Tierheilk.* **77.** 460–472. [For part I, see *V. B.* **13.** 160]. **748**

A comparison of flocculation tests, the Meinicke and Sachweh extracts being used, with a series of agglutination tests suggested that the Sachweh test was more sensitive than the aggln. test for the detection of brucella antibodies in milk samples. The Meinicke extract was shown to have little sensitivity.—R. S. de R.

Jones, E. R. (1943). **The Seasonal Variation in the Incidence of *Br. abortus* in Raw Milks.**—*J. Path. Bact.* **55.** 357–362. **749**

A series of 722 bulk milk samples taken at different times of the year was investigated for the presence of *Brucella abortus*. The incidence attained a maximum

about January and a minimum in August. About 15% of all the milk samples proved to be infected.
—R. S. DE ROPP.

DACORSO FILHO, P., & DE AZEVEDO, A. G. (1941.) Actinobacilose dos bovinos. [**Actinobacillosis in Cattle**].—*Rev. milit. Med. vet., Rio de J.* **4.** No. 29. Reprint pp. 12. **750**

The authors record, it is stated, for the first time in Brazil, two cases of actinobacillosis in cattle. Anatomical, histopathological, and bacteriological details are given.—ISOBEL W. BURTON.

GALE, E. F. (1943). **Factors Influencing the Enzymic Activities of Bacteria.**—*Bact. Rev.* **7.** 139–173. **751**

The subject matter of this review, which is designed to outline the types of variation that the enzymic constitution of bacterial cells may undergo in response to alterations in their external environment, is treated under three main headings. In the first section, which deals with variations due to chemical factors in the growth medium, enzymic alterations related to the presence of the specific substrate, presence of substances other than the specific substrate, and sub-optimal supply of growth factors are discussed. It is pointed out that Karström's classification into " adaptive enzymes " (produced only when required, *i.e.*, presence dependent upon adaption of organism to a specific substrate) and " constitutive enzymes " (formed by the cell independently of composition of growth medium) is an over-simplification, since it appears that many of the " strictly adaptive " enzymes are actually formed to a small extent in the absence of the specific substrate. The second section deals with variations due to physical factors such as oxygen tension, medium pH, and temperature, while the third is concerned with factors such as age of culture, permeability of cell membrane, and cell division. G. suggests that each cell in a growing culture has an enzymic constitution determined by the environmental conditions holding at the moment of its division, and that the effects due to " age of culture " or " life cycle " represent the results of continuously changing environmental conditions on continuously dividing—and chemically active—cells.

A brief section deals with technique in relation to the preparation of active cell suspensions. The review contains references to over 100 papers.—J. L. MCGIRR.

HARRIS, A. H. (1943). **Experiments with Collodion Sacs on Inhibition of Bacterial Growth *in Vitro*.**—*J. Bact.* **45.** 147–154. **752**

The experiments described in this paper were made because, in previous *in vitro* studies of the effect of sulphanilamide upon *Bacterium coli* grown for four hours in collodion sacs suspended in a liquid synthetic medium which could be changed periodically by an automatic device, the bacteria had failed to show demonstrable proliferation even in the absence of the drug. To elucidate this phenomenon, small numbers of *Bact. coli* were inoculated into (1) the liquid synthetic medium, (2) the boiled medium, (3) a dilute solution of thioglycollic acid in the medium, and (4) a mixture of the medium and a Berkefeld filtrate of a *Bact. coli* culture. In each experiment, the inoculum was introduced into a collodion sac, which was placed in an apparatus permitting a periodic change of the fresh liquid medium bathing the sac (two diagrammatic figures are given). Results showed that the initiation of growth of even relatively large inocula was delayed or prevented by frequent change of the medium surrounding the sac, while the initiation of growth was prompt in control tubes and also, in spite of corresponding frequent change of fresh medium, if the milieu of the original suspension was altered in certain ways. The studies confirmed the fact that the physical properties of a culture medium are of supreme importance and that a medium may appear to be actually bactericidal even when other factors are favourable for growth, if the bacteria are prevented from establishing conditions requisite for the initiation of growth.
—R. O. MUIR.

See also absts. **849** (*Str. bovis*), **783** (relation of streptococci to encephalitis), **917** (mastitis), **919** (TB.), **920** (salmonella), **922** (staining methods for sputum, pus and exudates), **924** (bacteria morphology), **923** (statistical methods in bacteriology).

DISEASES CAUSED BY PROTOZOAN PARASITES

BAX, S. N. (1943). **A Practical Policy for Tsetse Reclamation and Field Experiments. Part I.**—*E. Afr. agric. J.* **9.** 2–13. **753**

The types of vegetation and other conditions governing the distribution of the various species of tsetse flies of East Africa, and the factors which govern the spread or retrogression of fly infestation are briefly described. The establishment of " defence lines " to prevent further encroachment of tsetse is recommended where sufficient population is available to control regrowth of bush along the line of contact of tsetse and man. The method of reclamation adopted against *Glossina swynnertoni* by discriminative clearing of thorn savannah, and the clearing of hardpans at Shinyanga and Ukerewe peninsula, is described ; in the latter area 75,500 acres are being dealt with by the clearing of only 4,600 acres of hardpan. Attention is also drawn to the successful reclamation of *Combretum* and thicket bush infested with *G. pallidipes* at Mpapwa.

In gall-acacia plains infested by *G. swynnertoni* and *G. morsitans*, success has been obtained by severing the connexion between the bush of the plains and the surrounding " true home " of the fly, and by destroying breeding " islands " in the plains. In calcareous plains, where the principal bush vegetation is *Acacia*, *Hyphaene* palms and species of *Commiphora* and *Balanites*, it is necessary, in addition to breaking the contact between bush and plain, to deal with any *Acacia* tracts in the plain which could support tsetse. If *G. pallidipes* is present the thickets on the rivers must be removed.

Certain species of tsetse, *G. pallidipes*, *G. brevipalpis* and *G. austeni*, may disperse through woodland in favourable conditions, but at some seasons of the year are dependent on riverine and drainage bush, and can thus be dealt with by cutting out the undergrowth and smaller trees along the river beds. Foreshore and river clearings will kill out *G. palpalis*, and it has been shown that this species can be much reduced in riverine bush by the " block " method of catching out.

The method of concentration of population in order to establish tsetse-free areas in scantily populated infested bush is sketched [see also following abst.], and attention is drawn to townships which can be freed of tsetse by the cutting out of thickets, without interference with the large trees. Particular attention is drawn to the situation at Dar-es-Salaam. Legislation is in contemplation in Tanganyika Territory to regulate traffic to and from tsetse areas, and to provide for compulsory anti-tsetse measures where a majority of landowners desire them, or where the Government considers it advisable to introduce them.—U. F. RICHARDSON.

FAIRBAIRN, H. (1943). **The Agricultural Problems Posed by Sleeping Sickness Settlements.**—*E. Afr. agric. J.* **9.** 17–22. **754**

Maclean has estimated that a population density of 5–25 persons per sq. mile is most favourable for the epidemic spread of sleeping sickness. When a density of 50–80 is reached the country is generally sufficiently cleared to be practically fly free. The breaking of the contact between man and the tsetse fly in fly-infested areas can be done only by the establishment of large compact settlements which are completely cleared of bush. The method of concentration of population as practised in Tanganyika is described; in computing the area required for settlement, an allowance of 16 acres per family is made. It was realized that if these settlements were to be made permanent, improved methods of agriculture were essential in order to maintain soil fertility. The first attention was given to crops, and goats were readily introduced, but there was more difficulty with cattle. Government cattle were introduced from the sixth year onwards, being usually kept near the dispensary, "slided" [presumably means that microscopic blood examinations were carried out], and treated by the hospital dresser as required.

The demonstration that cattle could be safely kept in the settlements was usually followed by the introduction of native-owned herds. A scheme has now been proposed to maintain soil fertility, by getting the natives to bed down their cattle in covered sheds, thus producing sufficient high-grade manure to manure the fields every fourth year. The scheme depends for its success on the assumptions that 3½ acres of the local (*miombo*) country will maintain a beast in good milking condition, and allow for full growth, and that the application of 3 tons of manure every fourth year will maintain soil fertility.—U. F. RICHARDSON.

BURTT, E. (1942). **Observations on the High Proportion of Polymorphic Trypanosome Infections Found in the Salivary Glands of *Glossina brevipalpis* near Amani, Tanganyika Territory, with a note on the Appearance of the Infected Glands.**—*Ann. trop. Med. Parasit.* **36.** 170–176. **755**

In examining the salivary glands of *G. brevipalpis*, near Amani in Tanganyika Territory, a general trypanosome infection rate of 0·84% was encountered. In the low-lying area of Masherwa, where it is presumed that a warmer temperature prevailed, the gland infection rate was 1·04%, one of the highest recorded in nature. Marked fluctuation in the proportion of infected flies occurred even between catches on consecutive days. Most of the salivary gland infections were extraordinarily heavy, only three light infections being observed.

Infected glands in *G. brevipalpis* appeared chalky white by reflected light and could be recognized by the naked eye. Under the low power of the microscope some infected glands appeared brown or black, and it is suggested that these represented old infections. The trypanosome involved was not determined.—U. F. R.

AUGUSTINE, D. L. (1943). **Some Factors in the Defense Mechanism against Reinfection with *Trypanosoma lewisi*.**—*Proc. Amer. Acad. Arts Sci.* **75.** 85–93. **756**

Massive doses of *T. lewisi*, injected intraperitoneally into rats recently recovered from a previous infection, resulted in a peritoneal infection which disappeared within 48 hours, and a blood infection which appeared within an hour and persisted from a few minutes to several days. Evidence was obtained that the trypanosomes would pass uninjured through the lymph nodes of rats which had recovered from a previous infection, and that multiplication occurred in the blood, but that there was little increase in the trypanosome population, as the dividing forms were susceptible to antibodies present in the blood. Whilst mature forms might persist for some time, the infestation ended by their agglutination in the blood, and their removal probably by phagocytosis in the organs. No definite proof of the phagocytosis of the trypanosomes was demonstrated, but remnants of agglutinated parasites were detected in the small vessels of the liver, and an increased amount of débris was present in the Kupffer cells.

It is uncertain whether the antibody producing the destruction of the dividing forms is the same as that causing agglutination of the adult forms, but apparently ablastin is not involved in immunity to reinfection.
—U. F. RICHARDSON.

DAVIS, D. J. (1943). **Infection in Monkeys with Strains of *Trypanosoma cruzi* Isolated in the United States.**—*Publ. Hlth Rep., Wash.* **58.** 1006–1010. **757**

It has been found that bugs belonging to various species of *Triatoma* in Texas and California are infected with a trypanosome resembling *T. cruzi*, but little information is available as to the infectivity of this organism for man. By applying the faeces of infected bugs from these areas to the intact ocular tissue of monkeys, the invasion of the bloodstream was demonstrated in every case. Four out of ten monkeys also developed bipalpebral oedema, the conjunctival tissue showing fibroblast proliferation and focal infiltration with lymphocytes, plasma cells, and large mononuclear cells. Leishmania forms of the parasite were found near the foci of infiltration.—U. F. RICHARDSON.

DAVIS, D. J. (1943). **An Improved Antigen for Complement Fixation in American Trypanosomiasis.**—*Publ. Hlth Rep., Wash.* **58.** 775–777. **758**

The preparation is described of a culture antigen for complement-fixation tests for Chagas' disease, it being claimed that the keeping qualities are superior to those of other antigens. The organism is grown on a 2% agar medium to which 0·5% glucose and 10% defibrinated rabbit blood are added. About 25 ml. of the medium is slanted into large tubes and covered with 25 ml. of an infusion containing 2% proteose peptone no. 3 and 0·5% glucose, the tubes being incubated at 25°–28°C. for ten days after inoculation. The broth containing the organisms is centrifuged rapidly to deposit the trypanosomes, which are then washed three times in saline and then in 1 : 10,000 merthiolate solution. About 0·5 ml. of deposit is obtained from 20 tubes. This deposit is frozen and then slowly thawed, the process being repeated three times, and it is then kept tightly stoppered at 4°–6°C.

A good antigen will fix complement when diluted 60–80 times. Seven lots tested after six months had all retained their potency, two lots tested after a year showed only slight diminution of potency, whilst one lot kept for a month at room temperature and another lot kept in a waterbath at 37°C. exhibited only slight reduction.—U. F. RICHARDSON.

STABLER, R. M. (1941). **The Morphology of Trichomonas gallinae (= columbae).**—*J. Morph.* **69.** 501–515. **759**

This work was undertaken in view of the disagreement existing between previous descriptions of *T. gallinae*. The studies were made on material from the upper digestive tracts of pigeons, domestic turkeys, golden eagles, and several species of hawks. S. found that satisfactory microscopic preparations were obtained when either Schaudinn's fluid + 5% glacial acetic acid or weak Flemming's solution were used as fixative. The latter is better for demonstration of the parabasal apparatus. Staining was usually carried out with Heidenhain's non-alum haematoxylin. The average size of *T. gallinae* was found to be $10{\cdot}5\mu \times 5{\cdot}2\mu$. S. did not observe, in the axostyle, the internal granules or the chromatic ring reported by previous workers.

The parabasal apparatus appears to consist of two parts, one long and fibrillar and the other short and thick. There are four anteriorly directed flagella and a fifth forms the margin of the undulating membrane. The frequent presence of white blood cells within the organism indicates the presence of a cytostome which is not always identifiable. An interesting observation recorded is that numbers of flagellates may become attached to epithelial cells of some hosts. Large sometellas, regarded as abnormal forms, were noted. The illustrations are most valuable.—C. HORTON SMITH.

MALIANDI, F. B. (1943). La haemoproteosis de la Paloma. [*Haemoproteus* **Infection in the Pigeon**].—*Rev. Med. vet., B. Aires.* **24.** 127–139. **760**

M. describes the occurrence in Argentina of *H. columbae* infection and its usual vector, *Lynchia maura*. The life-cycle of the parasite is illustrated and the symptoms and course of the disease are described. —MILLER WATSON.

DEVINE, J., & FULTON, J. D. (1942). **The Pigment Formed by *Plasmodium gallinaceum* Brumpt, 1935, in the Domestic Fowl.**—*Ann. trop. Med. Parasit.* **36.** 167–170. **761**

The nature of the pigment produced in avian malaria had not previously been studied, probably because the available material was limited by the size of the usual laboratory host, the canary. The discovery, in 1935, of *P. gallinaceum* in the blood of the domestic fowl suggested a ready source for this material. Spectroscopic examination showed that the pigment was identical with haematin. Chlorine estimations carried out on the crude pigment used for spectroscopic examination showed that it was haematin and not the chlorine derivative, haemin, as no chlorine was present. Estimation of the iron content of two samples gave percentages of 1·95 and 1·96 corresponding to approximately 22% of haematin.—C. HORTON SMITH.

SERGENT, ET. (1940). Paludisme des oiseaux. Réceptivité des moustiques à l'infection du Plasmodium relictum. [*Plasmodium relictum* **Infection in Mosquitoes**].—*Arch. Inst. Pasteur Algér.* **18.** 214–215. **762**

The receptivity of Algerian *Aëdes aegypti* to *P. relictum* infection was compared with that of *Culex pipiens*. Mosquitoes of each species were allowed to feed on the same heavily infected canary. Mosquito stomachs were examined for oocysts five days after the feed: 94% of the 111 *C. pipiens* and only 5% of the 115 *A. aegypti* examined were found to carry oocysts. It is concluded that in Algeria the receptivity of *C. pipiens* is very high, in contrast to that of *A. aegypti* which is very low.—C. HORTON SMITH.

BOYD, G. H., & GILKERSON, S. W. (1942). **Influence of Conditions of Latency upon Merozoite Production and Gametocyte Survival in *Plasmodium catherium* Infections of Canaries.**—*Amer. J. Hyg.* **36.** 1–5. **763**

There is a marked resistance to superimposed infection with *P. cathemerium* in existing latent infections with the same organism. The authors observed a 20% decrease in the number of merozoites formed by the schizonts in superimposed infections as compared with new infections. Conditions prevailing in the blood of birds carrying old malarial infections appear to retard the rate of multiplication in superimposed infections. When gametocyte-infected blood is transferred to birds with latent infections and to previously uninfected birds, it is found that the gametocytes are removed less rapidly in latently infected birds than in previously uninfected birds as compared with the rate of removal of asexual parasites.—C. HORTON SMITH.

NÓBREGA, P., & REIS, J. (1942). Identidade dos toxoplasmas de aves e de mamíferos. [**Identity of Toxoplasms of Birds and Mammals**].—*Arq. Inst. Biol., S. Paulo.* **13.** 21–28. [English summary]. **764**

The authors describe experimental work which tends to show that the toxoplasms of birds and mammals are identical. Pigeon toxoplasms proved to be infective in the same way as mammalian toxoplasms to g. pigs, mice, and chicks. Immune serum prepared in monkeys against mammalian toxoplasms had marked value against pigeon toxoplasms.

The authors prepared a serum against pigeon toxoplasms by injecting fowls with a suspension of liver from an infected pigeon.—MILLER WATSON.

RAHIMUDDIN, M. (1942). **Hepatozoon canis and its Treatment.**—*Indian vet. J.* **19.** 153–154. **765**

Nine cases of *H. canis* infection in dogs were confirmed at Vizagapatam (S. India). Characteristic symptoms noted were progressive anaemia, paleness of the buccal mucous membrane and conjunctiva, intermittent fever, and lumbar paralysis.—H. N. RAY.

RAMANARAYANAN, S. (1942). **Bovine Piroplasmosis in Coonoor and Surroundings of the Nilgiris District.**—*Indian vet. J.* **19.** 143–146. **766**

Out of 22 cases studied by R., four were infected with *Babesia bigemina* and the rest with *Theileria mutans*. Symptoms noted in the latter infection were of a milder type than in the former. It is claimed that in cases of *T. mutans* infection a single injection of 10 ml. per 100 lb. body weight of a 1% solution of acriflavine gave satisfactory results. Two cases of *B. bigemina* infection treated with 30 ml. of 1% solution of acriflavine and/or 80 ml. of 1% solution of trypan blue were fatal, while two other animals which received acaprin, 4–6 ml. subcutaneously, recovered.—H. N. RAY.

DA SILVA LEITÃO, J. L. (1943). Descrição em Portugal duma Françaiella, Yakimoff, 1927. A memória de Carlos França. [**Description of a *Françaiella* Isolated in Portugal**].—*Rev. Med. vet., Lisboa.* **38.** 94–107. **767**

The author describes an organism, causing a form of piroplasmosis in Portugal, with the general characteristics of *Babesiella*. Round, oval, rod-shaped, and fusiform parasites are described; in some cases more than two were found in a single red corpuscle. The author gives his reasons for preferring the name *Françaiella*.—MILLER WATSON.

See also absts. **882**, **895** (trypanosomiasis), **896** (canine coccidiosis), **897**, **898** (equine and canine piroplasmosis), **925** (avian malaria).

DISEASES CAUSED BY VIRUSES AND RICKETTSIA

—. (1943). **Virus Diseases. By Members of the Rockefeller Institute for Medical Research.** pp. ix +170. Ithaca, New York: Cornell University Press. [8vo]. **768**

The book is divided into sections as follows:—"Virus Diseases with Particular Reference to Vaccinia" by T. M. RIVERS; "Chemical Structure and the Mutation of Viruses" by W. M. STANLEY; "New Hosts as a Key to Progress in Plant Virus Disease Research" by L. O. KUNKEL; "Swine Influenza" by R. E. SHOPE; "Human Influenza" by F. L. HORSFALL, Jr.; and "Viruses and Tumours" by P. ROUS.

GLASER, R. W., & STANLEY, W. M. (1943). **Biochemical Studies on the Virus and the Inclusion Bodies of Silkworm Jaundice.**—*J. exp. Med.* **77.** 451–466. **769**

A study of the polyhedral intranuclear inclusion bodies of silkworm jaundice showed that, while they are usually active, there is no great concentration of virus activity within them. They appear to be composed of a large amount of inert material which has the ability to protect the contained virus from the effect of acids and other chemical substances. On the whole, the evidence does not support the view that the inclusion bodies represent crystallized virus.—I. W. BURTON.

—. (1943). Medidas para combatir la aftosa. Exhortación de la Dirección de Ganadería. [**Control of Foot and Mouth Disease. Appeal by the Division of Livestock**].—*Bol. mens. Direcc. Ganad., Montevideo.* **27.** 195–199. **770**

An article written for breeders, stressing the losses caused to the livestock industry by foot and mouth disease. Measures of control are detailed, together with penalties imposed for infringement of the regulations.

DE BASTERRECHEA ELORRIETA, L. (1943). La "Estomatitis seudo-aftosa" o "Estomatitis vesiculosa" en Venezuela y sus diferencias bacteriológicas y clínicas con la "Glosopeda o Fiebre aftosa". [**Vesicular Stomatitis in Venezuela, and its Differential Diagnosis from Foot and Mouth Disease**].—*Rev. Med. vet., B. Aires.* **24.** 175–176. **771**

Vesicular stomatitis is a common disease in Venezuela. A description is given of its symptomatology and differential diagnosis from F. & M. disease.—M. W.

SCHNEIDER, I. S. (1942). Fenômenos paralíticos consequentes à vacinação antirábica. (Tentativa de tratamento pela ação da estricnina). [**Paralysis in Dogs Following Vaccination against Rabies. Treatment with Strychnine**].—*Bol. Soc. brasil. Med. vet.* **11.** 163–166. **772**

S. reports the occurrence of posterior paresis or partial paralysis in three out of four dogs inoculated against rabies. The animals recovered under treatment with strychnine.—MILLER WATSON.

PALMEIRO, J. M. (1942). Um caso de teteira na cabra, transmitida pela criança (?). [**Udder Pox in a Goat, Possibly Transmitted through an Infant**].—*Rev. Med. vet., Lisboa.* **37.** 238–242. **773**

P. describes a case of udder pox in a goat, which was kept isolated from other animals, in a district where there were no other cases of variola of domestic animals at the time. The owner of the goat stated that a child recovering from an attack of small pox had been in the habit of playing with the goat. P. suggests that this may have been a case of human variola affecting a domestic animal. Unfortunately, attempts to isolate a virus from the goat were unsuccessful.—M. WATSON.

TAYLOR, A. R., SHARP, D. G., BEARD, D., BEARD, J. W., DINGLE, J. H., & FELLER, A. E. (1943). **Isolation and Characterization of Influenza A Virus (PR8 Strain.**—*J. Immunol.* **47.** 261–282. **774**

A series of purified preparations of influenza A virus was obtained from infected allantoic fluid by differential high-speed centrifugation, adsorption of virus on chick red cells etc. These preparations, when examined by the electron microscope, failed to reveal any significant differences in structure. The predominant material consisted of particles which were roughly spherical in shape with an indentation of the surface; although slight variations in size existed, the particles were essentially of the same magnitude (mean diameter 77·6 mμ). The sedimentation constant in Ringer-$CaCl_2$ solution measured to the midpoint of the boundary was $S_{20°} = 724 \times 10^{-13}$ giving a particle diameter of about 80 mμ. A proportion of the particles obtained from unpurified virus fluids were small elements 15 mμ or less in diameter, but these were also recovered from normal egg fluids: in addition, these particles were lacking in viral activity. This observation does not, therefore, support the contention of CHAMBERS & HENLE [*V. B.* **13.** 353, abst. 2363.] that the infectious element is a particle with a size of about 10 mμ: moreover, no definite evidence has yet been produced to show that particles of relatively large size act as "carriers" for infective units of relatively small size. —R. E. GLOVER.

I. HIRST, G. K., & PICKELS, E. G. (1942). **A Method for the Titration of Influenza Hemagglutinins and Influenza Antibodies with the Aid of a Photoelectric Densitometer.**—*J. Immunol.* **45.** 273–283. **775**

II. HIRST, G. K. (1942). **In vivo Titrations of Influenza Virus and of Neutralizing Antibodies in Chick Embryos.**—*Ibid.* 285–292. **776**

III. HIRST, G. K. (1942). **Direct Isolation of Human Influenza Virus in Chick Embryos.**—*Ibid.* 293–302. **777**

I. A simple photoelectric densitometer was constructed for measuring the amount of sedimentation of chick red cells in a given system. The red cell suspension was calibrated by measurements of dilutions varying from 10–100%: the readings in microamperes plotted against the red cell dilutions give a fairly straight line. By constructing suitable graphs the percentage density of an unknown suspension was easily determined by interpolation. The new method considerably shortened the time necessary for estimating the end-points in the haemagglutinin test.

II. A comparison was made between the titres of various strains of influenza virus when tested in mice by the usual intranasal technique and after introduction into the allantoic sac of chick embryos, the presence of virus being determined by the haemagglutination test (HIRST). The occurrence of pulmonary lesions is the most sensitive index of infection in mice, but the embryo method gives positive results beyond the maximum dilution causing visible mouse lung involvement. It was found, in addition, that whenever agglutination occurred with embryonic fluid, the lethal titre for the mouse invariably fell between $10^{-4\cdot0}$ and $10^{-4\cdot5}$. The period of optimum concentration of virus in allantoic fluids occurred after 48–72 hours' incubation. The concentration of haemagglutinins in the allantoic fluid from a single egg was a fairly accurate index of infection and of multiplication of virus in the individual embryo.

The neutralization of virus by immune serum was also demonstrated in chick embryos: in general, the end-points obtained were sharper than in the titration of virus. The antigenic differences known to exist between PR8, WS, and swine strains and the complete lack of antigenic relationship between influenza virus A (PR8) and virus B (Lee) was confirmed.

III. Recent investigations by ANDREWES *et al.* [*V. B.* **12.** 211.] failed to substantiate the claim of BURNET [*V. B.* **12.** 24.] that strains of influenza virus can be isolated from human throat washings by inoculation of chick embryos. H. has examined numerous throat washings from individuals whose convalescent serum showed a fourfold increase or more in complement-fixing antibodies when tested against PR8.

The washings (unfiltered) were inoculated into ferrets whose sera were tested for antibodies against PR8: at the same time a filtrate was introduced into the chick embryo (technique described). Allantoic fluids were assayed for haemagglutinins: if they were

negative, the embryo tracheas were subinoculated into fresh embryos and the process repeated until a positive result was obtained (maximum five passes). It was found that only 28 of 54 washings, all of which were positive by the ferret method, reacted in the embryo. When, however, the ferrets received filtrates, only 17 out of 30 of the above washings were positive. The identity of the viruses thus isolated was determined by the haemagglutinin inhibition test, standard ferret sera (anti-PR8 and anti-Lee) being used ; all the strains fell into the influenza A group.

The neutralization test in chick embryos [see II, above] confirmed the serum-inhibition test. It had the advantage that the complications due to inhibiting substances in normal ferret sera were avoided. Five of these strains infected ferrets and embryos to a high titre, but were of very low pathogenicity for the mouse.
—R. E. GLOVER.

CASELLA, G. J. (1943). Meningitis cerebro espinal. Breves consideraciones con una observación personal. Transmisión de esta enfermedad al hombre. **[Transmission of Equine Encephalomyelitis to Man]**.—*Rev. Med. vet., B. Aires.* **24.** 54–68. **778**

This is a general paper on E.E. and its transmission to human beings. C. cites two cases of children being affected in areas where there was an outbreak of the equine disease. He considers that there should be compulsory vaccination of all Argentine army horses with chick-embryo vaccine.—MILLER WATSON.

I. CUNHA, R. (1941). Da transmissão a animais domésticos de um virus da encefalomielite equina, isolado na Baía (Brasil). **[Transmission to Domestic Animals of a Virus of Equine Encephalomyelitis Recovered from a Mule in Bahia, Brazil]**.—*Rev. milit. Med. vet., Rio de J.* **4.** pp. 34. [English summary]. [Only reprint seen]. **779**

II. CUNHA, R. (1941). Encefalomielite equina. Imunidade cruzada entre os virus " Oeste ", " Este " e um virus isolado na Baía. **[Equine Encephalomyelitis. Cross-Immunity between Western and Eastern Virus and a Virus Isolated at Bahia, Brazil]**. —*Bol. Minist. Agric., Rio de J.* December. pp. 13. [Only reprint seen]. **780**

III. CUNHA, R. (1942). Relação imunológica entre o virus da encefalomielite equina, isolado na Baía, e o virus rábico. **[Immunological Relationship between the Virus of Equine Encephalomyelitis, Isolated in Bahia, Brazil, and Rabies Virus]**.—*Ibid.* pp. 2. [Only reprint seen]. **781**

I. This is a study of an E.E. virus isolated from a mule in Bahia. Swiss mice, white rats, cats, dogs, goats, and sheep were infected experimentally by intracerebral or subdural inoculation. Symptoms appeared generally from the 5th–7th day, and death occurred on the 7th–9th day.

II. By cross-immunity experiments in g. pigs, it was demonstrated that the E.E. virus isolated in Bahia differs immunologically from the Eastern and Western E.E. viruses. The Bahia strain fails to grow in the chorio-allantoic membrane of chick embryos.

III. The serum of rabbits immunized against rabies, contains antibodies which will neutralize the Bahia encephalomyelitis virus and *vice versa*.

Swiss mice immunized against rabies are able to resist rabies better than Bahia virus infection, but resistance to the Bahia virus is greatly augmented if the animals receive an intracerebral injection of rabies virus after immunization. Swiss mice immunized against the Bahia virus are equally resistant to rabies and Bahia virus infection. An excellent resistance to rabies is stimulated by the intracerebral injection of Bahia virus into mice previously immunized against Bahia virus.
—ISOBEL W. BURTON.

DE SOUZA, S. M. (1943). Encefalo-mielite equina no Ceará. **[Equine Encephalomyelitis in the State of Ceara, Brazil]**.—*Campo, Rio de J.* No. 163. pp. 11–12. **782**

The incidence of E.E. is stated to be increasing in the state of Ceará. This article describes the features of the disease, method of immunization, and precautions to be taken to prevent further spread of infection.
—ISOBEL W. BURTON.

ROSENOW, E. C. (1942). **The Relation of Neurotropic Streptococci to Encephalitis and Encephalitic Virus.** —*Proc. Mayo Clin.* **17.** 551–560. **783**

R. has frequently claimed to have isolated neurotropic streptococci from the brains of animals, birds, and fish affected with encephalitis. He states that similar streptococci were recovered also from insects, from samples of air and dust, and from river and lake water.

It is now reported that these organisms and remote subcultures of them produced encephalitis in a high proportion of g. pigs and mice inoculated intracerebrally or intralingually. The organisms were recovered from the brain of the inoculated animals which died, and in these instances an encephalitis virus was also isolated. R. deduces that the virus represents the filtrable phase of the streptococci. A transmissible encephalitis was also produced in mice by exposure to nebulized cultures of streptococci. Similar results followed the administration of cultures to fish by contamination of their tank water.

From the mouse experiments it is inferred that the spread of streptococci by air was a major factor in the occurrence of epidemic encephalitis in 1941.
—R. E. GLOVER.

BOSIO, A. H. (1943). Sobre un caso de fiebre catarral maligna o coriza gangrenosa de los bovinos. **[A Case of Bovine Malignant Catarrh]**.—*Rev. Med. vet., B. Aires.* **24.** 229–232. **784**

A record of a case of bovine malignant catarrh.
—ISOBEL W. BURTON.

VIRVIESCAS, F. (1942). Hog-colera o peste porcina. **[Swine Fever in Colombia]**.—*Rev. Med. vet., Bogotá.* **11.** 603–607. **785**

The author reports the occurrence of S.F. in Colombia for the first time. Lesions and laboratory methods of diagnosis are described.—MILLER WATSON.

*LÖFSTEDT, F. (1941). Valpsjuka hos hund. **[Dog Distemper]**.—*Skand. VetTidskr.* **31.** 539–541. [Abst. from abst. in *Zbl. Bakt. I. (Ref.).* **142.** 519]. **786**

For protection against dog distemper, L. employs Dunkin & Laidlaw's serum-virus method of vaccination. In outbreaks of the disease, dogs are given hyperimmune serum (intravenously or intramuscularly), at the rate of 2 ml. per kg. body weight, together with sulphonamides, given orally four times daily, 0·5 g. for a small, and 1·0 g. for a large animal, to protect against secondary invaders. Sulphapyridine appeared to be of value as did vitamin B, the latter particularly in young dogs during convalescence.—A. R. JENNINGS.

RISER, W. H. (1943). **Infectious Panleukopenia of Cats.**—*N. Amer. Vet.* **24.** 293–299. **787**

A review of the disease, including definition, history, aetiology, methods of transmission, pathogenesis, gross and microscopic pathology, symptoms, mortality, diagnosis and differential diagnosis, and treatment. In a series of 34 cases, R. found the most constant lesions to be a greasy and semi-fluid appearance of the bone marrow and haemorrhagic oedematous

swelling of the lymph nodes draining the terminal ileum. Symptomatic treatment is discussed.—E. C.

BEACH, J. R. (1943). **Avian Pneumoencephalitis.**—*N. Amer. Vet.* **24.** 288–292. **788**

This is the same condition as that described as "a respiratory-nervous disorder of chickens" [see STOVER —*V. B.* **12.** 537]. The disease has been definitely identified in California only, but may occur elsewhere. The causative agent is a virus, found most readily in the lungs in natural cases. When chicks are affected, the outbreaks usually begin as a respiratory trouble, affecting up to 100% of the flock, followed by nervous disorders in 1–45% of the flock. The average mortality is 5–10%. In older birds, nervous symptoms are not seen, and mortality is negligible. In artificially infected birds, on the other hand, the nervous form is that characteristically seen. The important feature of the disease is that adult birds, recovered from the disease, have been shown to carry the virus in their lungs.
—E. COTCHIN.

I. DELBRÜCK, M., & LURIA, S. E. (1942). **Interference Between Bacterial Viruses. I. Interference between Two Bacterial Viruses Acting upon the Same Host, and the Mechanism of Virus Growth.**—*Arch. Biochem.* **1.** 111–141. **789**

II. LURIA, S. E., & DELBRÜCK, M. (1942). **Interference Between Inactivated Bacterial Virus and Active Virus of the Same Strain and of a Different Strain.**—*Ibid.* 207–218. **790**

I. In order to study the interference phenomenon as applied to "viruses", two strains of bacteriophage α and γ active against a common bacterial host (*Bacterium coli*) were used. The plaque produced by each strain was readily recognizable. Two variants (A. & C.) were obtained from the original bacterial host (B.) by the selective activity of α and γ. The relation between these components is represented graphically as

$$\begin{array}{ccccc} A & & B & & C \\ \nwarrow & \nearrow & \nwarrow & \nearrow & \\ & \alpha & & \gamma & \end{array}$$

in which $\rightarrow$ represents lysogenic activity. This system permitted a study of α and γ on the common host both separately and under mixed conditions.

It was found that if each bacterium was infected with both "viruses", only γ was liberated, α being suppressed unless it was present in very great excess. It was also noted that both qualitatively and quantitatively multiple infection of a bacterium with several "virus" particles had the same effect as infection with a single particle.

A theory is elaborated that the action is not due to the direct effect of the "virus" on the bacterial cell, but to the intermediary of a "key enzyme" which is present in the cell and conditions the production of "virus". The "γ versus α interference" is thus tentatively explained as a competitive blockade of an enzyme present in the host in limited amount.

II. Further experiments showed that "virus" γ inactivated by heat lost its interfering capacity. On the other hand, varying grades of interference were observed with "virus" inactivated by ultra-violet (U.V.) irradiation, the suppression of α "virus" by irradiated γ diminishing progressively with increased periods of irradiation. A single, partially inactivated particle was sufficient to suppress the growth of virus α in one bacterium.

According to the "key enzyme" theory, U.V.-inactivated γ "virus" ought to have interfered with the growth not only of α but also of normal γ "virus": such proved to be the case. Partially inactivated γ "virus" adsorbed by sensitive bacterial cells inhibited their growth without producing lysis and also interfered with the formation of active γ "virus".

The bearing of these findings on the successful use of irradiated viruses of animal and plant origin, *e.g.*, rabies virus, is discussed.—R. E. GLOVER.

RAKIETEN, T. L., & RAKIETEN, M. L. (1943). **Bacteriophagy in the Developing Chick Embryo.**—*J. Bact.* **45.** 477–484. **791**

While inoculation of the chorio-allantoic membrane of ten-day-old chick embryos with *Bacterium flexneri* caused the death of 38 out of 39 embryos within 1–3 days, introduction of bacteriophage "Hdys" (comprising three phage types) five hours after similar infection, protected 32 out of 44 embryos from death for at least six days. Twenty-seven of these survivors proved to be free of bacteria and the egg material from them contained more phage than was originally inoculated. Material from eggs, the embryos of which had died, showed a reduction in the amount of phage, and with one exception contained secondary lysogenic strains of the original culture which had only acquired a resistance to one of the phage types. The five surviving embryos found to be infected contained a secondary culture resistant only to the same phage type. It is considered that the developing chick embryo is an ideal subject for the study of bacteriophage activity because of the intimate contact which is possible between the phage and bacteria, the absence of other strains of bacteria, ease of handling, and low cost.—T. M. D.

VAN DEN ENDE, M., STUART-HARRIS, C. H., HARRIES, E. H. R., STEIGMAN, A. J., & CRUICKSHANK, R. (1943). **Laboratory Infection with Murine Typhus.**—*Lancet.* **244.** 328–332. **792**

Twelve laboratory workers engaged in research on typhus fever were accidentally infected with murine typhus. In 11 of them, infection was probably due to the inhalation of infective droplets during intranasal inoculation of mice under ether anaesthesia. All workers had had at least one course of killed rickettsial vaccine and it is considered that this had conferred partial immunity.—JOHN FRANCIS.

KRONTOVSKAYA, M. K. (1942). Uspekhi sovetskikh uchenykh v izuchenii rikketsiozov. **[Advances in Soviet Research on the Rickettsiases].**—*Zh. Mikrobiol., Moscow.* No. 11/12. pp. 59–61. **793**

This is a discussion on the development of Soviet research on rickettsiases. The chief work on epidemiology, histology of lesions, vaccination against *R. prowazeki*, and cultivation of the organism, is discussed.

There is also a short report on three rickettsial infections which have recently been recognized and investigated in the U.S.S.R.; one of these occurs on the Black Sea coast and is probably identical with Marseilles fever; the second was met with in the Far East, Central Siberia, and the Chabarovsk district and was identified as Malayan typhus, type W.; the third, occurring on the Caucasian Black Sea shore, was related to murine typhus.—A. MOLDAWSKY.

See also abst. **806** (resistance to viral infection).

IMMUNITY

—. (1943). **Discussion on Immunity. III.—Immunity to Tuberculosis.** [Speakers: KAYNE, G. G., GLOVER, R. E., CRUICKSHANK, R., & NASSAU, E.]—*Proc. R. Soc. Med.* **36.** 471–475. [For previous parts, see *V. B.* **13.** 286]. **794**

—. (1943). **Discussion on Immunity. IV.—Immunity**

to Bacteria. [Speakers: BOSWORTH, T. J., HUGHES, W. H., ROBERTSON, M., DALRYMPLE-CHAMPNEYS, W., & FRANCIS, J.]—*Ibid.* 475–479. **795**

—. (1943). **Discussion on Immunity. V.—Immunity to Viruses.** [Speakers: LEDINGHAM, J., DOYLE, T. M., ANDREWES, C. H., & MCCLEAN, D.]—*Ibid.* 479–482. **796**

III. KAYNE drew attention to species differences in the relation of natural and acquired immunity to TB., natural resistance being the ability of the body to deal with the bacillus on first contact with it, and acquired resistance acting through the hypersensitivity of tissues previously exposed to infection. In regard to man, the immunity in races with a high natural resistance was reinforced by a primary infection whereas in those with a low natural resistance, this was not the case. In all probability, bronchogenic TB. in man was always associated with a primary complex however insignificant, whereas in rabbits, races with a high natural resistance could develop a bronchogenic TB. following a first infection with the bacillus [see also *V. B.* **14.** abst. 726].

GLOVER discussed the possibility of establishing breeds of animals with an enhanced natural resistance by a process of selection, and cited experiments by CARMICHAEL [*V. B.* **10.** 694.] and others, indicating that certain strains of native cattle, *e.g.* Zebu, possessed to a high degree a natural resistance against the disease. With regard to induced immunity, the value and limitations of vaccines composed of acid-fast bacilli in slowly absorbable oily substrates was considered, and reasons given why the high hopes held by earlier investigators had not been fulfilled. Brief reference was also made to the protection of calves and g. pigs with BCG and with heat-killed organisms. Particular attention was directed to the need for a careful consideration of the routes and weight of infection and the effect of frequent exposures when planning experiments on immunity. As far as possible, natural routes should be employed, *i.e.* the alimentary or respiratory tracts should be attacked.

In answer to a question by CRUICKSHANK, NASSAU stated that experiments in pigs and g. pigs receiving a first-class protein in the diet indicated that there was a longer survival period and less extensive lesions of TB. than in controls which were less well fed.

IV. BOSWORTH drew attention to the encouraging results reported by various authors in the prevention of anaerobic infections of animals by means of formalin-treated preparations (anatoxin and anaculture). A plea was made for a more general employment of highly potent vaccines and sera as a means of conserving supplies of home-produced foods. The vaccines which had proved of particular value were those of *Clostridium chauvoei*, *Cl. septicum*, *Cl. welchii*, and *Cl. oedematiens*. In the case of *Cl. welchii* infection, it seemed that immunity to the toxin was more important than bacterial immunity. Care had to be taken, however, to be certain that the strains used were capable of producing not only the amount but also the kind of toxin required, since alterations in character or loss of capacity to elaborate toxin might arise on subculture. Formalin-treated toxin of *Cl. welchii* behaved like diphtheria toxoid in provoking primary and secondary stimuli which were linked with the immune responses. In general, it seemed to be accepted that a formalin treated culture was often superior to anatoxin: this applied in particular to *Cl. oedematiens* in which some strains were predominantly invasive.

ROBERTSON pointed out that in experiments in mice *Cl. septicum* protection could be obtained on purely antibacterial and on purely antitoxic lines.

HUGHES suggested that in many diseases the natural stimuli evoked was inadequate and should be reinforced by the inoculation of vaccines. In certain localized lesions, a capsular barrier was formed which effectively impeded the production of antibodies normally formed as a result of a primary stimulus. In such instances recourse to vaccination was essential if the antibodies were to be raised to an effective level. This argument was illustrated by reference to staphylococcal infections.

DALRYMPLE-CHAMPNEYS thought that more attention should be devoted to the study of non-specific immune mechanisms.

FRANCIS drew attention to a recent report by BAZELY on the value of very young encapsulated cultures of *Streptococcus equi*, cautiously killed by heat, in the immunization of horses against strangles.

V. LEDINGHAM believed that since the search for methods of inactivating viruses which would not impair their antigenicity was making slow progress, dependence would probably have to be placed on suitable living variants which could be used with safety. He supported this contention by reference to cow-pox, rabies, and poliomyelitis. The "interference" phenomenon recently studied by several workers indicated that where a highly virulent virus was combined with another virus or similar agent of lesser potency, the former failed to exercise its usual effect, but might be converted into a useful immunizing agent, *e.g.*, mixtures of neurotropic yellow fever virus and vaccine lymph. With regard to virus-neutralizing antibodies, it should be remembered that an increase in humeral antibodies as a result of vaccination was not necessarily a guide to the host's power of resistance to attack. This was particularly the case in human influenza where in all probability local defence mechanisms, such as virus-inactivating substances in nasal secretions, might be of great importance. New knowledge regarding the harbouring of virus agents by apparently healthy animals was reviewed with special reference to rabies, psittacosis, equine encephalitis, and lymphocytic choriomeningitis.

ANDREWES, referring to the "interference" phenomenon, cited investigations by DELBRÜCK & LURIA [see absts. 789 & 790] showing that of two phages active on a strain of *Bacterium coli*, one could completely suppress the growth of the other. He suggested that the protective effect of vaccination subsequent to exposure to smallpox might be explained on these lines.

DOYLE discussed recent experiments on the immunization of pigs to swine fever with crystal-violet vaccine. Details were given of potency tests made on various batches. It was stated that, in general, 97% of vaccinated pigs were adequately protected.

MCCLEAN drew attention to the necessity for the production of a specific lesion in vaccinia if a good immunity was to be induced.—R. E. GLOVER.

FARMER, L. (1942). **The Rôle of the Endocrines in Anaphylaxis and Allergy. I. Hormonal Influences in Anaphylaxis; a Critical Review. II. Hormonal Influences in Allergy; Clinical Observations.**—*Ann. intern. Med.* **17.** 212–222. **797**

I. Twenty-three papers are cited relating to the effects on anaphylactic reactivity of thyroid extract, thyroidectomy, adrenalin, adrenal cortex extract, adrenalectomy, anterior and posterior pituitary extracts, hypophysectomy, follicular hormone, and pregnancy. F. reaches the general conclusion that endocrine secretions exert a marked influence on anaphylactic reactivity, notably by affecting the capacity to produce antibody during the sensitization process, and by influencing reactivity after sensitization is established. He indicates, however, that more precise information is

required, relating to quantitative considerations and to the sex and age of the animals used.

II. Clinical observations are presented which demonstrate the influence of hormones on allergic conditions. F.'s experience appears to be that hormone-influenced allergic conditions in human beings occur most frequently in women, and that such cases generally have clinical connexions with the menstrual cycle, the menopause, or pregnancy. In certain of the cases cited, oestrogenic therapy had beneficial results.—J. L. McG.

BIRKHAUG, K. (1941). **Specific Allergy, Anaphylaxis, and Antibacterial Immunity in Tuberculosis.**—*Acta med. scand.* **109.** 250–294. **798**

B. describes a series of experiments designed to throw further light on the problem of the relationship between allergy, anaphylaxis, and immunity in TB. The tuberculo-protein used throughout the investigations was obtained by trichloracetic acid precipitation of a Berkefeld filtrate derived from an unheated three-week-old culture of BCG. Results and conclusions derived from the experiments described are as follows.

(1) Natural BCG tuberculo-protein possesses high tuberculin activity and is capable of sensitizing g. pigs, but not rabbits, to fatal anaphylactic shock. It does not possess immunizing properties nor does it sensitize g. pigs allergically. (2) Serum from anaphylactically sensitized g. pigs (which give birth to anaphylactically sensitive young) is capable of sensitizing normal g. pigs, provided that it contains demonstrable specific precipitins. (3) In experimental infection, true bacterial anaphylaxis succeeds allergic hypersensitiveness in the later stages of the disease, its appearance being concomitant with that of specific precipitins in the circulation. (4) True bacterial allergy cannot be passively transferred. (5) Abolition of tuberculo-anaphylactic sensitization by specific desensitization (non-fatal anaphylactic shock) fails to remove tuberculo-allergic sensitivity. (6) Abolition of tuberculo-allergic sensitization by tuberculin desensitization fails to remove tuberculo-immunity, and the latter can be developed without the former. (7) Tuberculo-allergy is apparently independent of specific antibodies, while tuberculo-anaphylaxis is intimately concerned with such substances.

B. concludes that the three tuberculo-biological phenomena of anaphylaxis, allergy, and immunity are independent and separable, and that their concomitant appearance in subacute and chronic TB. is merely fortuitous.

There is a bibliography of 90 references.

—J. LOCHIEL McGIRR.

CHOUCROUN, N. (1943). **Biological Effects of a Toxic and a Sensitizing Substance Isolated from Paraffin Oil Extract of Dead Tubercle Bacilli.**—*Science.* **98.** 327–329. **799**

C. claims that injections of the sensitizing substance previously reported as present in liquid paraffin extracts of tubercle bacilli [see *V. B.* **11.** 172 and 424.] appear to be capable of protecting g. pigs against TB.

—J. LOCHIEL McGIRR.

OLSON, C., Jr. (1943). **The Inheritance of an Agglutinogen of the Chicken Erythrocyte.**—*J. Immunol.* **47.** 149–154. **800**

The agglutinogens of erythrocytes of a family of inbred Rhode Island Red chickens were studied by means of the agglutinins present in normal bovine serum. Three types of erythrocyte were identified by cross-absorption tests. Type I removed all agglutinins from bovine serum, type II removed agglutinins for type II cells only, type III removed agglutinins for types II and III cells. A genetic study indicated that the inheritance of the agglutinogen pattern could be explained on the basis of a single pair of allelic genes.

—F. D. ASPLIN.

DURLACH, A. L. (1943). Influencia de la temperatura sobre los antígenos somáticos. **[Influence of Temperature on the Somatic Antigens of Salmonella].**—*Rev. Fac. Agron. B. Aires.* **10.** 326–343. [English and Portuguese summaries]. **801**

Salmonella somatic antigens III, IV, and X are stable, as far as agglutinability is concerned, after being heated to 99°C. and 120°C. for four hours and 75–100 min. respectively. Antigenic fractions V, XII, and XXVI are appreciably altered by this treatment. Fractions V and XXVI fail to react with corresponding sera and fraction XII reacts very slowly. Fraction IX is unchanged by heating, or is altered so as to produce delayed agglutination.—ISOBEL W. BURTON.

HERSHEY, A. D. (1943). **Experiments with Bacteriophage Supporting the Lattice-Hypothesis.**—*J. Immunol.* **47.** 77–87. **802**

Experiments with bacteriophage relating to the specificity of aggregation are described. In principle, the procedure adopted was to compare the rate of deposition of sensitized coliphage from solution, when mixed with a suspended specific precipitate of the same coliphage, with the rate of deposition from the same mixture of an immunologically unrelated sensitized staphylococcal phage. Sensitized phage was found to adhere firmly to homologous specific precipitate but not to heterologous specific precipitate. It was also found that a specific reaction occurred between sensitized and unsensitized phage in solution. With the systems tested (phage, serum proteins, type III pneumococcal polysaccharide, *Bacterium coli*, *Brucella*) no evidence was obtained that sensitization made antigens sticky or that any mechanism auxiliary to lattice formation was operating. H. submits that his experimental findings can only be explained in terms of the "lattice hypothesis" and antibody multivalance, his conclusion being that the aggregative stage of immune precipitations is primarily a reaction between the immunospecific valencies responsible for the initial combination of antibody and antigen.—J. LOCHIEL McGIRR.

SÁ VIANA CONTE, H., & COELHO, F. F. (1942). Ensaios de vacinação de éguas gestantes com anatoxina tetânica. **[Vaccination of Pregnant Mares with Tetanus Anatoxin].**—*Repos. Lab. Pat. vet., Lisboa.* **5.** 17–30. **803**

Pregnant mares were vaccinated with tetanus anatoxin, some for the first time; some had been vaccinated before.

The antitoxic titres that developed in the sera of both mares and foals were sufficient to protect against natural infection. The titres in the revaccinated mares and their foals were appreciably higher than those of the animals vaccinated for the first time.—I. W. BURTON.

HALD, A., JERSILD, M., & RASCH, G. (1943). **On the Determination of the Phagocytic Power of Leucocytes. A Study in Economic Design of Experiments.**—*Acta path. microbiol. scand.* **20.** 64–85. [In English]. **804**

This is a detailed discussion of methods for determining opsonic index, taking as a basis Huddleson's simplified method for brucella in which the bacteria within 25 leucocytes are counted and classified—number of leucocytes containing 0, 1–20, 21–40, and $\geqq$ 41 bacteria. The authors consider that the distribution of the leucocytes with respect to the number of bacteria engulfed is better represented by using the grouping 0, 1–15, 16–35, 36–50.

In any series of experiments there must be con-

sidered the degree of accuracy required and the relationship between the mean and standard deviation with the technique in use. It can then be decided how many leucocytes should be counted and also tables can be constructed from which a "phagocytic index" can be calculated. The most reliable detailed method for expressing the degree of phagocytic activity is by using Fisher's principle of likelihood, but this procedure is too laborious for routine work.

The organisms used for this study and the technique involved in preparing the material for counting are not mentioned.—E. G. WHITE.

DOLD, H. (1942). Die Bakterien-Inhibinwirkung (bakteriostatische Wirkung) sterilen Submaxillaris-Speichels des Hundes. [**Bacteriostatic Action of Sterile Submaxillary Saliva of Dogs**].—*Z. Hyg. InfektKr.* **124.** 519–530. **805**

Sterile secretion of the submaxillary gland was obtained from two dogs; unheated specimens showed an inhibiting effect upon the growth of bacteria (air bacteria, *Bacillus mycoides*, *B. anthracis*, *Corynebacterium diphtheriae*), as compared with secretion which had been boiled prior to inoculation.—J. G. CARR.

TAYLOR, H. M., & SPRUNT, D. H. (1943). **Increased Resistance to Viral Infection as a Result of Increased Fluid in Tissues.**—*J. exp. Med.* **78.** 91–97. [See also *V. B.* **11.** 619]. **806**

Experiments on rabbits showed that administration of 0·2 mg. oestrogenic hormone (α-oestradiol dipropionate) in 1 ml. of sesame oil daily for three weeks increased the amount of fluid in the tissue. As it has already been shown [see SPRUNT & MCDEARMAN—*V. B.* **11.** 619.] that this hormone decreases the susceptibility of the rabbit to infection with vaccinia virus, it is suggested that the increased resistance is the result of an increase in the extracellular fluid in the skin. It was also found that intraperitoneal injection of a salt solution (6·5 g. NaCl + 2·5 g. $NaHCO_3$ in one litre of water) which increases the tissue fluids decreased the spread of India ink in the skin and reduced the susceptibility to vaccinia infection to the same extent as treatment with oestrogenic hormone. It is therefore concluded that an increase in tissue fluids, not only at the time of infection but throughout the course of infection, increases the resistance of the rabbit to infection with vaccinia virus. It is suggested that the increase in extracellular fluid localizes the virus [see also SPRUNT—*V. B.* **12.** 448.] or that the decrease in susceptibility may be the result of decreased cellular permeability.
—R. ALLCROFT.

See also absts. **726**, **727** (TB. immunity), **756** (immunity to trypanosomiasis), **719** (staphylococcal antitoxin), **883** (serum sickness).

PARASITES IN RELATION TO DISEASE [GENERAL]

GIOVANNONI, M. (1943). Principais parasitoses dos equinos. [**Principal Parasites of Horses**].—*Bol. Inst. Biol., Paraná.* No. 6. pp. 57. **807**

This is a small bulletin for the use of owners and breeders of horses. It lists the common protozoan and metazoan parasites of horses in Paraná and indicates the lines of prophylaxis and treatment.—MILLER WATSON.

CHIN, T. H., & LI, K. C. (1942). **A Survey of the Metazoan Parasites of the Domestic Cat,** *Felis domestica*, **of Kweiyang.**—*Chin. med. J.* **61A.** [Chengtu Edit. Vol. **1.**] 30–36. **808**

One hundred and twenty cats, purchased in the market, were examined for ectoparasites and for helminths. The animals were killed by anaesthesia, with the exception of a few which died whilst under observation, and were examined several hours later or the next morning. It is noted that this delay in examination probably influenced the finding of ectoparasites, some of which may have migrated from their normal sites. The examination showed only one cat to be free from parasites. 60% were found to be carrying fleas, of which four species were found, *viz*, *Ctenocephalus felis felis*, *Xenopsylla cheopis*, *Monopsyllus anisus*, and *Pulex irritans*. One species of louse (*Trichodectes* sp.) was found on only one of the cats. Trematodes were found in 61% of the cats, the following species being recovered :– *Pharyngostomum cordatum*, *Paragonimus*, *Fasciola hepatica*, and *Eurytrema* sp. Cestodes were present in 87·5% of the cats, four species being represented, *viz*, *Diphyllobothrium*, spargana, *Taenia taeniaeformis*, and *Dipylidium caninum*. 85% of the cats carried nematode infections, the nine species present being *Toxocara mystax*, *Ancylostoma brasiliense*, *A. caninum*, *Uncinaria* sp., *Thelazia callipaeda*, *Chlamydonema praeputiale*, *Cylicospirura* sp., *Dirofilaria immitis*, and *Capillaria* sp. Of the parasites discovered, the following are recorded for the first time for the cat in China :– *Xenopsylla cheopis*, *Monopsyllus anisus*, *Trichodectes* sp., *Fasciola hepatica*, *Eurytrema* sp., and *Uncinaria* sp.
—T. E. GIBSON.

PARASITES IN RELATION TO DISEASE [ARTHROPODS]

CAMERON, A. E. (1943). **Insect Pests of 1942.**—*Trans. Highl. agric. Soc. Scot.* **55.** 74–98. **809**

In the section of this article which deals with fly pests of livestock, special reference is made to horse bot flies, ox warble flies, and the sheep nostril fly. Illustrations and descriptions are given of the adult flies and their larvae. Their life-histories are described.

Of the three species of bot flies found in Great Britain, *Gastrophilus intestinalis* (= *G. equi*) is much more frequent than *G. nasalis* and *G. haemorrhoidalis*. To protect themselves against *G. nasalis*, horses will rest their heads on each others' backs, whilst against *G. haemorrhoidalis* they keep their heads down, rubbing their lips on the ground; they are much less apprehensive of *G. intestinalis*. A horse may support a large population of bots without any apparent inconvenience.

The Warble Fly (Dressing of Cattle) Order of 1936 was suspended in February, 1940, but farmers should continue to practise control voluntarily so that the measure of control gained in the four years' operation of the Order may not be lost.

Besides the well known symptoms of sheep nostril-fly infestation, there may be grating of the teeth, pawing with the front feet, and disordered gait not unlike that of true gid (*Coenurus cerebralis* infestation), hence the condition is often called false gid. The most important consequences are bronchial and lobar pneumonia following accidental migration of the maggots to the lungs.—A. MILNE.

DA SILVA LEITÃO, J. L. (1942). Tumores duodenais causados pelos larvas de Gasterophilus meridionalis Pillers e Ewans 1926, num cavalo do continente português. [**Duodenal Tumours in Horses in Portugal Caused by Larvae of** *Gastrophilus meridionalis*].—*Rev. Med. vet., Lisboa.* **37.** 243–246. **810**

In a number of horses slaughtered in the Lisbon municipal abattoir, the author found tumour-like growths in the duodenum between the pylorus and the orifice of the bile duct. Careful examination of one of the growths revealed the presence of second-stage larvae of *G. meridionalis*.—MILLER WATSON.

*CORIEZ, E. (1942). Compression médullaire par des larves d'hypoderma bovis? **[Spinal Compression Probably Caused by Ox-Warble Larvae]**.—*Ann. Méd. vét.* p. 161. [Abst. from abst. in *Skand. VetTidskr.* **32.** 838–840]. **811**

This is a case record of progressive posterior paresis in a cow. Diagnosis was made after slaughter, from the finding of a track from the spinal canal to the skin, together with local meningitis at the level between the lumbar and sacral regions. The warble larva presumed to be responsible for the lesions was not found and so could not be identified.—J. E.

COOLEY, R. A. (Undated). **Determination of Ornithodoros Species.**—*Publ. Amer. Ass. Adv. Sci.* No. 18. pp. 77–84. **812**

This is an extremely useful paper on the systematics of the genus *Ornithodoros*. The values of the different characters used for identification of ticks are discussed, and brief descriptions are given of 44 species.—J. B. C.

See also abstr. **808** (ectoparasites of cats in China), **899-902** (insecticides), **903-907** (gas fumigation for mange and lice).

PARASITES IN RELATION TO DISEASE [HELMINTHS]

PANDE, P. G. (1942). **Observations on Normal Worm Burden of Goats from Certain Districts in the United Provinces.**—*Indian J. vet. Sci.* **12.** 199–203. **813**

P. examined 120 healthy goats from certain localities in the United Provinces and found that the most commonly occurring worm was *Trichuris ovis*. Next in order of frequency were *Haemonchus contortus* and *Oesophagostomum columbianum*, *Stilesia globipunctata*, *Cysticercus tenuicollis*, *Trichostrongylus colubriformis*, *Bunostomum trigonocephalum*, paramphistomes, *Stilesia vittata* and *Avitellina centripunctata*, *A. lahorea*, *Fasciola gigantica*, *A. sudanea*, *Schistosoma indicum*, and *Moniezia expansa*. *Protostrongylus rufescens*, *Varestrongylus pneumonicus*, *Stilesia hepatica*, and *Coenurus cerebralis* were each encountered on one occasion only. Intensity of infestation is given in each case.—G. D. BHALERAO.

NEGHME, A., & OSSANDON, M. (1943). **Ectopic and Hepatic Human Fascioliasis.**—*Amer. J. trop. Med.* **23.** 545–550. **814**

A case of human fascioliasis is described, in which flukes were present in the liver and were also found in a tumefied area of the skin. Those in the skin region were immature, but the flukes situated in the liver had reached maturity. Treatment by the daily subcutaneous injection of 0·08 g. emetine hydrochloride (total dose 9·72 g.) was successful in reducing the dyspeptic discomfort accompanying the condition and in causing the disappearance of *Fasciola* eggs from the faeces.
—T. E. GIBSON.

SPINDLER, L. A., HILL, C. H., & ZIMMERMAN, H. E., Jr. (1943). **The Pathogenicity of Strongyloides Ransomi, the Intestinal Threadworm of Pigs.**—*N. Amer. Vet.* **24.** 475–486. **815**

In the tests made, pigs free from parasites (except *Balantidium*) were used, and were divided into two groups, (1) two test pigs and two controls, and (2) one test pig and one control, the source of infection being a pen containing moist straw, which had been contaminated with the faeces of pigs infested with *S. ransomi*. The pigs of (1) were exposed for 5–5½ weeks, whilst those of (2) were exposed for seven days. Restlessness and irritability were symptoms shown early in the infections as also was loss of appetite; other symptoms were diarrhoea, at first nocturnal but later continuous, lassitude, vomiting, and intestinal haemorrhage. Reduced growth rate and loss of weight were observed in all the test pigs. One of the test pigs of group one died five weeks after the beginning of infection, and at P.M. examination living third-stage larvae were recovered from the skeletal muscles, myocardium, tongue, larynx, oesophagus, brain and spinal cord, and the lungs. The test pig of (2) died two months after infection, but no larvae were recovered from its tissues at P.M. examination; the chief lesions observed were haemorrhages in the lungs, petechial haemorrhages on the heart, pericarditis, and thickening and congestion of the small intestine, with petechial haemorrhages on the mucous surface and free blood in the lumen. Comparison of the weights of control and infected pigs showed clearly that the infection had a very adverse effect on growth.
—T. E. GIBSON.

THRELKELD, W. L. (1942). **The Sheep Parasite Problem in Augusta County.**—*Bull. Va agric. Exp. Sta.* No. 343. pp. 12. **816**

T. planned to carry out a survey of the parasites of sheep bought in the market, four animals, not over one year old, being acquired each month throughout one year. No young animals were, however, to be obtained in January and February, and only three animals were bought in each of the months of January, February, and March. The ownership and history of the sheep were established subsequent to purchase. The purchased sheep were slaughtered and the worm burden of each was determined. A table is given showing the incidence of the various parasites found in the sheep, and from these data T. made a study of the seasonal incidence of the worms. Lambs born in January, February, and March were found to remain comparatively free from parasites until July, by the middle of which month *Haemonchus contortus* might be present in sufficient numbers to cause considerable unthriftiness. For this reason it is recommended that lambs be marketed before July 1st, and that those retained after that date should be given two treatments with phenothiazine with about two weeks' interval between the treatments. *Trichostrongylus* spp. were very numerous in the small intestine by November and it is recommended that a large dose of phenothiazine be given at the end of November or in December to control these and also *Oesophagostomum* and *Chabertia*. A fourth treatment between January and April for the further control of these species is also recommended. T. has used the benzidine test to examine faeces for the presence of blood. He concludes that although there are other diseases which cause the presence of blood in the faeces, a positive reaction usually indicates the presence of *H. contortus* in sufficient numbers to cause damage to the host.—T. E. GIBSON.

CUOCOLO, R., & MELLO, M. J. (1942). Sobre ovos não fecundados e pseudo-operculados de "Ascaris lumbricoides L., 1758" (Nematoda: Ascaridae). **[Unfertilized and Pseudo-Operculated Eggs of *A. lumbricoides*]**.—*Arq. Inst. Biol., S. Paulo.* **13.** 283–290. [English summary]. **817**

The authors studied a large number of eggs of *Ascaris lumbricoides* and found that a high proportion were not fertilized. These unfertilized eggs had only two envelopes, of which the outer one frequently had a

fault at one or both extremities which gave the appearance of an operculum. The fertile eggs were smaller than the sterile ones because of the absorption of the yolk and the contraction of the inner membrane. Measurements and illustrations are given.—M. WATSON.

MUDALIAR, S. V. (1942). **Agriostomum vryburgi Railliet, 1902.**—*Indian vet. J.* **19.** 125–128. **818**

The distribution of *A. vryburgi* is restricted to hilly tracts. M. records it for the second time from the Nilgiris in the intestine of a heifer calf. The worm is redescribed.—G. D. BHALERAO.

DA SILVA LEITÃO, J. L. (1942). As papilas cefálicas da dirofilaria immitis (Leidy 1856). [**The Cephalic Papilli of** *D. immitis*].—*Rev. Med. vet., Lisboa.* **37.** 234–237. **819**

The author's technique for the examination of the cephalic papillae of *D. immitis* consists in rolling the helminth between two slides on the stage of the microscope, using reflected light. The papillae appear successively and their distance from the end of the oesophagus can be measured. The number of cephalic papillae was found to be ten.—MILLER WATSON.

MACHADO, D. A., Filho. (1940). Ocorrência de "Oncicola canis" (Kaupp, 1909) Hall & Wigdor, 1918 no Brasil. [*O. canis* **in Dogs in Brazil**].—*Mem. Inst. Osw. Cruz.* **35.** 511–513. **820**

The author reports, for the first time, the occurrence of *O. canis* in dogs in Brazil. These acanthocephala were found in dogs destroyed in Rio de Janeiro. A description is given.—MILLER WATSON.

See also absts. **808** (helminths of cats in China), **908-911** (anthelmintics).

SPONTANEOUS AND TRANSMISSIBLE NEOPLASMS AND LEUCAEMIAS [INCLUDING FOWL PARALYSIS]

GREAT BRITAIN. (1943). **Twentieth Annual Report of the British Empire Cancer Campaign 1943.** [Edited by LOCKHART-MUMMERY, J. P.] pp. 92. London: British Empire Cancer Campaign. [4to]. **821**

This report presents an encouraging account of cancer research carried out at the various institutions to which the British Empire Cancer Campaign makes annual grants. Grants are made to more than 40 centres and individuals, not only in the United Kingdom but also in Australia, New Zealand, South Africa, and Canada. Due in part to the broadcast appeal, the income of the Fund in 1942–43 was more than twice what it had been in the previous year.

It is impossible within the scope of an abstract to do more than mention some of the advances made during the year under review. The use of diethylstilboestrol in prostatic cancer in man; evidence suggesting that certain diets exert an inhibiting influence on cancer of the mamma and liver in mice; the importance of species differences in chemical carcinogenesis; evidence suggesting that malignant growth is conditioned by disturbance in the so-called "heterochromatin" of tissue cells; the effect on the ovary of rabbits of varying doses of radium and radon; these are but a few of the subjects included in the Report. There are more than 50 references to articles published during the year and these represent only a proportion of the year's achievements.—E. G. WHITE.

VOEGTLIN, C. (1942). **Trends in Cancer Research.**—*J. nat. Cancer Inst.* **2.** 309–315. **822**

After a brief survey of the main points of historical interest in cancer research, V. proceeds to outline the present state of knowledge with regard to mammalian neoplasms. He points out the high specificity of malignant cells over many years in tissue culture, and gives reasons for believing that mammalian cancer is not due to a specific infectious agent. Passing on to the chemical aspect, he mentions 3,4-benzpyrene and 20-methylcholanthrene as two of the most potent carcinogenic compounds yet known out of about 250 carcinogenetic chemicals, and he expresses the opinion that fundamental cancer problems should be attacked from the viewpoint of cell physiology and biochemistry, and also from a study of the process of ageing. Attempts to cause carcinogenesis *in vitro* and a study of dietary factors in the production of induced tumours are then mentioned, especially the role of cystine; diets deficient in cystine cause inhibition of tumour growth.

The problem of spontaneous neoplasms is then discussed, particular attention being paid to the part played by sex hormones; mention is made of the possible carcinogenic action of cell-free extracts of tissues and urine from cancer patients, and a plea is made for more work on this particular aspect.

Finally, V. discusses the biochemical investigation of such tumours as the artificially induced rat hepatoma, with special reference to lactic acid production, glycogen and riboflavin content, and catalase activity. The possible association between low catalase content of malignant tumours and cancer cachexia is mentioned. —JOHN G. CAMPBELL.

INNES, J. R. M. (1943). **The Malignancy of Testicular Cancer in Man and Dogs.**—*Brit. J. Surg.* **31.** 157–160. **823**

This short paper deals mainly with the features of the relatively benign seminoma in the dog, with especial reference to survival of the animals after orchidectomy. The cases summarized in the table have already been described in a previous article [*V. B.* **13.** 176.]. Seminomas in man and the dog are identical pathologically, but they appear to be considerably more benign in the latter species; the author considers it possible, however, that seminomas in man may be less malignant than is generally believed. The need for more research on spontaneous cancer in animals is stressed.—E. G. WHITE.

BLUMENFELD, C. M. (1943). **Studies of Normal and of Abnormal Mitotic Activity. II. The Rate and the Periodicity of the Mitotic Activity of Experimental Epidermoid Carcinoma in Mice.**—*Arch. Path.* **35.** 667–673. [For part I, see *V. B.* **14.** 96]. **824**

B. has studied the rate and periodicity of mitotic activity in squamous cell carcinomas in male mice, induced by application to the skin of 0·3% methyl cholanthrene in benzene. In normal mice the epidermal cells showed a diurnal rhythm; the maximal rate of mitotis occurred between 8 a.m. and 12 noon and was about four times the minimal rate, which was observed between 8 p.m. and midnight. In contrast to this, the neoplastic cells showed no diurnal rhythm, mitotic activity being almost constant throughout the day and night. The mitotic activity of the neoplastic cells was not at any time greater than the maximal activity of the normal epidermal cells in an equal volume of tissue. —E. G. WHITE.

PEACOCK, P. R., & BECK, S. (1943). **Multiple Mesenteric Sarcomata in Rats Following Ingestion of Heated Lard.**—*Brit. J. exp. Path.* **24.** 143–146. [Authors' summary copied *verbatim*]. [See also *V. B.* **12.** 234]. **825**

1. Rats maintained on (a) adequate diet, (b) restricted diet (bread or potatoes and milk), to which were added lard heated to 220°C. or 350°C., developed multiple mesenteric sarcomata in 4 out of 71 animals surviving more than 300 days. These animals were not infested with *Cysticercus fasciolaris*, which is known to be associated with sarcoma in the liver of infested rats. 2. Some rats on the restricted diet also developed benign gastro-papillomatosis. 3. Among 11 rats infested with *Cysticercus fasciolaris* 3 developed spindle-cell sarcomata attributable to the parasite. 4. Reasons are given for thinking that multiple mesenteric sarcomata in uninfested rats fed with heated fat were induced by a potential carcinogen acting on the mesoblastic tissues encountered in the process of absorption.

CAMPBELL, J. G. (1943). **Histiocytic and Fibroplastic Sarcoma (Mixed-Cell Sarcoma) in the Domestic Fowl.** —*J. comp. Path.* **53.** 323–328. **826**

C. describes in detail, with illustrations, a case of neoplasia in a Buff-Rock hen involving the right kidney, right adrenal, and both lungs. It is probable that the primary site was the kidney. The cellular components of the tumours comprised fixed histiocytes, free macrophages, fibroblasts, tumour giant cells, and lymphoid and myeloid cells : all degrees of transition were present between the first four types. Many of the giant cells bore a strong resemblance to unipolar ganglion cells, but further investigation showed that they were not neurogenic in origin, *viz*, occurrence of phagocytosis, absence of neuroblasts and neurofibrils, and the presence around the cells of reticulin fibrils.

The direct transformation of the cytoplasm of fibroblasts to collagen and the intra-cytoplasmic formation of this substance are described and illustrated. This is of considerable interest in view of the controversy among cytologists as to whether collagen is formed from condensation of intercellular liquid material secreted by fibroblasts or from cytoplasmic prolongations.

The tumours are classified as histiocytic and fibroplastic sarcoma (" mixed-cell sarcoma "). Some areas bore a marked resemblance to the Rous sarcoma no. 1. —E. G. WHITE.

CARR, J. G. (1943). **Some Investigations upon the Nature of the Resistance of an Inbred Line of Fowls to the Development of the Rous No. 1 Sarcoma.**— *Brit. J. exp. Path.* **24.** 127–132. [See also *V. B.* **10.** 609]. **827**

Working with a Rous-sarcoma-resistant strain of Brown Leghorn chickens, the non-susceptible or N-S line, C. has shown that Rous no. 1 agent inoculated in varying doses into six-week-old fowls produces tumours which progress normally for the first 14 days, then cease growing and harden, or soften and disappear by the 22nd day. Similar results obtain when Rous sarcoma cells are implanted. The resistance is present in day-old chicks and also in older birds, but in both cases to a lesser extent. Experiments to ascertain whether neutralizing antibodies are the cause of the resistance showed that N-S sera does not contain these substances. Additional evidence is given to support this. C. tried grafting the chemically induced GRCH/15 sarcoma into N-S birds and found that they also show a distinct resistance to this non-filtrable tumour. Reasons are given for believing that the N-S line is resistant to other filtrable tumours.—JOHN G. CAMPBELL.

CARR, J. G. (1943). **The Relation between Age, Structure, and Agent Content of Rous No. 1 Sarcomas.** —*Brit. J. exp. Path.* **24.** 133–137. **828**

Using chicks 6–9 weeks old, C. found that the amount of active agent extractable from Rous no. 1 tumours was inversely proportional to the duration of the growth in the host. Thus the greatest amount of agent occurred in the youngest tumours, whilst after 40 days' growth, no agent was demonstrable. This decrease in activity may be due to an inhibitory substance elaborated by the fowl or the tumour. It is known that the sera of young chicks possess no anti-Rous activity and in older birds the sera often contain " naturally occurring " antibodies to Rous no. 1 agent.

The appearance of the tumours is no guide to the amount of agent obtained in extracts.—J. G. CAMPBELL.

CARR, J. G. (1943). **Prolonged Antibody Production Following Recovery of Fowls from Rous No. 1 Sarcoma.**—*Brit. J. exp. Path.* **24.** 138–140. **829**

It is known that in fowls which have recovered from a single injection of Rous no. 1 virus, tumours sometimes recur many months after the original tumours have vanished, and that Rous no. 1 virus can be recovered from these tumours. The virus must therefore have remained in such birds in a latent form for a prolonged period.

C. carried out experiments to ascertain whether recovered birds carried constant antibodies in their sera. It was found in every case that serum from a recovered fowl conferred protection on susceptible chicks when mixed *in vitro* with virus, the mixture injected some hours later.—JOHN G. CAMPBELL.

MILLER, F. R., & TURNER, D. L. (1943). **The Action of Specific Stimulators on the Hematopoietic System.** —*Amer. J. med. Sci.* **206.** 146–158. **830**

The authors have previously reported that repeated injections in g. pigs of suitable extracts of the urine of patients with myeloid or lymphoid leucaemia cause proliferation of the corresponding type of cell. They now describe further experiments confirming and elaborating their earlier work. Injections of urine fractions from human cases of myeloid leucaemia caused proliferation of myeloid cells in the liver, spleen, adrenal, and bone marrow in all the animals injected ; in some animals similar proliferation occurred in the lungs, kidneys, and lymph nodes. Fractions from the urine in cases of lymphoid leucaemia gave rise to changes closely simulating those seen in this disease in man—enlargement of the spleen and lymph nodes which in the latter organs sometimes caused rupture of the capsule.

It is claimed that two different chemical agents are concerned in producing these changes, and a theory is elaborated in an attempt to explain the development of various types of leucaemia. The lymphoid substance is considered to cause lymphoid proliferation and myeloid maturation : in contrast, the myeloid substance causes myeloid proliferation and lymphoid maturation. An excess of one agent causes the corresponding leucaemia, deficiency of both results in hypoplastic or aplastic anaemia, and excess of both causes Hodgkin's disease.—E. G. WHITE.

I. HALL, W. J., BEAN, C. W., & POLLARD, M. (1940). **Preliminary Report on the Propagation of the Fowl-Leucosis Virus on Chick Embryos by Intravenous Inoculation.**—*J. Amer. vet. med. Ass.* **97.** 247. **831**

II. HALL, W. J., & POLLARD, M. (1943). **Further Studies on the Propagation of Fowl Leucosis in Chick Embryos by Intravenous Inoculation.**—*Amer. J. vet. Res.* **4.** 287–293. **832**

I. This is a preliminary report, stating that 3·5% of inoculated chick embryos developed leucosis.

II. The work has now been continued with the following results :–

2,656 chick embryos were inoculated intravenously with leucosis blood during 30 serial passages, resulting in the development of leucosis in 1,089 (41%), either

in the embryonic stage or within a week after hatching. Of the total inoculated, 621 (23·3%) hatched and of these 389 (62·6%) developed leucosis. There were 1,257 (47·3%) undetermined cases, this high percentage being due to rapid degeneration of the embryonic tissue caused by the heat of the incubator after death, the material consequently being spoilt for diagnostic purposes. The incubation period and course of the disease in the embryo averaged 7·4 days and the corresponding period in embryos which survived long enough to hatch was 14·8 days.

Of the 30 serial passages, 16 were from egg to egg exclusively while in each of the remaining 14 passages a few embryos were inoculated with blood from embryos after hatching. These totalled 297 of 11% of the total inoculated. The technique of inoculation and of bleeding embryos after inoculation is described.

Diagnosis of the disease in embryos was made by peripheral blood smears from the live embryo, infection being indicated by the presence of large numbers of haemocytoblasts in the blood. P.M., tissue impression smears and sometimes microscopic sections were made. Young chicks were injected with embryo blood ; of 55 young chicks injected with embryo blood from ten different passages, 32 (58·2%) died of leucosis in an average period of 22 days.

Gross changes in infected embryos consisted of enlargement of the liver, spleen, and kidneys while histological examination showed flooding of the bloodstream with lymphoid (haemocytoblast) cells. In the liver, in addition to these cells in blood vessels and sinusoids, there was usually extensive perivascular infiltration, and occasionally areas of focal necrosis were seen. Similar changes were frequently seen in the kidneys and spleen.—J. D. Blaxland.

Pierce, M. (1942). **Studies on Fowl Leucosis. Transfer to the Chick Embryo.**—*Amer. J. Path.* **18.** 1127–1139. **833**

Lesions of leucosis were produced in chick embryos by the inoculation of the chorio-allantoic membrane with spleen cells, leucocytes, and plasma of fowls affected with fowl leucosis. P. could not demonstrate lesions or growth of virus in embryos inoculated with Berkefeld filtrates of leucotic tissues, although filtrates were infective for chicks.—F. D. Asplin.

Jeffrey, F. P., Beaudette, F. R., & Hudson, C. B. (1942). **The Role of Breeding in the Control of Fowl Paralysis.**—*Bull. N. J. agric. Exp. Sta.* No. 696. pp. 4. **834**

A brief account of the results achieved during the period 1932–40 in an attempt to breed strains of fowls resistant and susceptible to fowl paralysis. The incidence of paralysis in both resistant and susceptible lines fell from 30·0% and 29·8% in 1934 to 3·5% and 10·1% respectively in 1940. There was considerable variation in the incidence from year to year. Diagnosis was based upon macroscopic examination only.—F. D. Asplin.

DISEASES, GENERAL

Schmidt & Reiter. (1942). Bericht über eine Reise nach Gadàmes. [**Report on a Tour to Gadames (West Tripolitania)**].—*Berl. Münch. tierärztl. Wschr.* Dec. 25th. 377–381. **835**

This report on a journey through Libya to Gadàmes gives notes on the various types of domestic animals encountered, their utility, and the methods of animal husbandry and feeding under desert conditions. Horses, donkeys, camels, sheep, goats, and cattle were encountered, mainly of African breeds, but a herd of European cattle was kept at Gadàmes for the use of the military garrison. Disease is said to be rare, due to the dryness of the climate and the small animal population. Mange is a serious condition in camels, being treated by the application of wood tar and sulphur. The cattle at Gadàmes suffered from a disease of the eyes, and the calves from diarrhoea. Both conditions are ascribed to the use of concentrates for feeding and the absence of local grazing.—U. F. Richardson.

Baldomir, A. (1943). Sobre los perjuicios ocasionados por la sequía.—Informe elevado al Ministerio de Ganaderia y Agricultura. [**Livestock Losses from Drought in Uruguay**].—*Bol. mens. Direcc. Ganad., Montevideo.* **27.** 7–14. **836**

This is an account of heavy losses amongst livestock caused by the drought in the early part of 1943. In some provinces of the Argentine, losses of cattle amounted to 30% and over.—Miller Watson.

Lerena, E. A. (1943). Mal seco o de sequía, en vacunos. Enfermedad enzoótica, caracterizada por dispepsia aguda y constipación. [**" Drought Sickness " in Cattle**].—*Rev. zootéc.* **30.** No. 251. 16–18. **837**

L. describes a disease of cattle occurring in the Argentine during the drought of 1942.

The principal symptoms were obstinate constipation, irregular or suspended rumination, dyspnoea, and tachycardia. The temperature remained normal, the animal had difficulty in moving, and there was partial paresis of the hindquarters with muscular tremors behind the elbow. Finally the animal became exhausted, was unable to rise and death ensued. At P.M. examination the heart was found to be dilated, all the muscular tissue was pale in colour, and the stomachs were impacted with hard material. Treatment with purgatives proved of little use, but animals put to graze on oats recovered.

L. mentions a similar disease of horses in the south of the Argentine that appears to be rather like " grass sickness " of horses which occurs in Great Britain.

—Miller Watson.

Götze, R. (1942). Über Weidekrankheiten des Rindes. [**Diseases and Accidents of Pastured Cattle. I, II & III**].—*Dtsch. tierärztl. Wschr.* **50.** 281–286 and 344–349. **838**

A review, with photographs, of diseases and accidents which occur in cattle on pasture. It includes lacerations from barbed wire or thorn hedges, foot injury by foreign bodies, etc., sunburn, lightning strike, and poisoning of many types (by fertilizers, industrial smokes, midge bites, and plants).—J. E.

Greig, J. R. (1943). **Diseases of the Sheep. A General Discussion.**—*Trans. Highl. agric. Soc. Scot.* **55.** 16–36. **839**

The conditions dealt with are lamb dysentery, pulpy kidney disease, enterotoxaemia, braxy, scrapie, contagious pustular stomatitis, louping-ill, tick-borne fever, pyaemia in lambs, pine, swayback, " double scalp " (cause obscure—possibly phosphorus deficiency), " lambing sickness ", pregnancy toxaemia, enzootic abortion, and photosensitization.—N. S. Barron.

—. (1943). **Recommendations on Swine Disease Control to Meet Wartime Needs. Special Committee on Diseases of Swine.**—*J. Amer. vet. med. Ass.* **102.** 180–186. **840**

The Committee state that the request of the Secretary of Agriculture for a 15% increase in pork products for 1943 will necessitate (1) breeding more sows, (2)

raising a larger percentage of pigs farrowed, and (3) perhaps feeding to heavier marketing weights. The mortality rate of pigs on North American farms is stated to be 30–40% of those farrowed. Measures to reduce losses should include (1) improved breeding, (2) improved feeding, (3) improved management, and (4) improved disease control. These points are all discussed, the importance of good husbandry in the control of swine diseases being stressed.

The following diseases are also briefly discussed, with notes on aetiology, symptoms, treatment (if any), and control :– swine fever, swine erysipelas, paratyphoid, haemorrhagic dysentery, coccidial enteritis, scour and anaemia in unweaned pigs, swine influenza, swine plague, pneumonia, brucellosis, swine pox, hypoglycaemia in newborn pigs, parasitism.

The importance of proper sanitation in the control of most specific infectious diseases is emphasized, with a recommendation that due attention be given to this by farmers, veterinarians, livestock officials and others concerned.—T. M. DOCKER.

WIRTH, D. (1942). Die Eosinophilie des Blutes. [**Eosinophilia**].—*Arch. wiss. prakt. Tierheilk.* **78.** 10–12. **841**

This is a short note on eosinophilia in domestic animals and includes several original observations of interest. Myositis of the masticatory muscles in the dog is accompanied by an intense eosinophilia (up to 32% eosinophiles), possibly caused by liberation of muscle proteins from the damaged muscle fibres. W. records a case of generalized sarcomatosis in a dog in which the eosinophile count was 10% (total leucocyte count 12,580). In assessing the clinical importance of the eosinophile count, it is pointed out that the absolute number of eosinophiles should always be ascertained by making a total leucocyte count as well as a differential count. It is possible to obtain an eosinophile count more rapidly by counting the cells directly on the haemocytometer slide, the following diluting fluid being used :– 10 ml. of 1% aqueous eosin, 10 ml. acetone, 80 ml. distilled water.—E. G. WHITE.

NETTLESHIP, A. (1942). **Bone-Marrow Changes Produced by Specific Antibodies.**—*Amer. J. Path.* **18.** 689–697. **842**

G. pigs were given 16 intramuscular injections, at intervals of a fortnight, of an aqueous extract of the macerated bone marrow of rabbits, containing the proteins precipitated with acetone. Rabbits were then injected intravenously with the pooled g. pig serum containing rabbit bone-marrow antibodies. Differential leucocyte counts were made at 5, 10, and 15 min. and 24 hours after the injection and the animals finally examined P.M., special attention being paid to the marrow in the femur, pelvis and sternum, and the spleen.

Neutrophile leucocytes fell almost to zero within 15 min. after the injection of serum and a relative lymphocytosis persisted for 24 hours. Rabbits receiving repeated injections of serum at various intervals showed a similar immediate fall in neutrophile leucocytes, followed later by a slight leucocytosis. Single injections caused capillary dilatation, haemorrhage, and focal necrosis in the bone marrow, followed by regeneration and hyperplasia. Repeated injections caused proliferation of fibrous connective tissue with dense fibrosis and the development of cysts. The final picture closely resembled the lesions seen in osteitis fibrosa in man. —E. G. WHITE.

BRØCHNER-MORTENSEN, K. (1942). **Iron Content of the Serum in Lesions of the Liver and Bile Passages.** —*Acta med. scand.* **112.** 277–290. [In English]. **843**

Of 26 patients suffering from acute hepatitis, 69% had serum iron concentrations of over the normal maximum limit (taken as 200 μg. %). Variation of the serum iron in single individuals was great, but the maximum values were usually observed in the second week of illness. No significant rise in serum iron was observed in cases of cirrhosis of the liver, jaundice due to cancer, or choleliathiasis.—RACHEL MARSHALL.

GREENE, C. H. (1943). **Physiologic Considerations in the Treatment of Portal Cirrhosis.**—*J. Amer. med. Ass.* **121.** 715–719. Discussion pp. 719–720. **844**

A paper which includes a brief summary of the age incidence and clinical picture of portal cirrhosis as studied in a series of 108 patients at the New York Post-Graduate Hospital, and two case reports. Reference is made to recent experimental work on the production of hepatic cirrhosis by dietary means in rats and g. pigs, and it is stated that clinical trials in man indicate the value of high-protein, high-vitamin diets in the treatment of portal cirrhosis. It is stated also that infusions of ascitic fluid appear to have some value in conserving blood protein and in treating hypoproteinaemia in selected cases.—ALASTAIR N. WORDEN.

GREENE, R. (1943). **The Immediate Vascular Changes in True Frostbite.**—*J. Path. Bact.* **55.** 259–267. **845**

The tails of mice were frozen for 1 min. at –62°C., and were amputated at varying times afterwards. In tails amputated immediately after freezing, the caudal artery was constricted, but no other change was seen. Tails amputated 5 min. after freezing, when thawing was almost complete and colour was returning, showed changes in the part of the tail doomed to ultimate necrosis ; in this distal segment, the blood in the vessels appeared as a shrunken pigmented mass, in which the outlines of red corpuscles could be seen, and there was some swelling of the vascular endothelium. 30 min. after freezing, the contraction of arteries throughout the tail had passed off, but signs of early necrosis were seen in the distal segment. Subsequent changes were directed to the separation of the necrotic tip.

Freezing for longer periods produced a similar clumping of red cells in the vessels, but oedema was more pronounced.

The "silting-up" of the vessels by red blood corpuscles probably accounts for the necrosis observed, and true thrombosis, though it may occur as a secondary phenomenon, is not concerned in the process.—E. C.

CAMERON, H. S., & BRITTON, J. W. (1943). **Chronic Ovine Laryngitis.**—*Cornell Vet.* **33.** 265–268. **846**

A disease characterized by abscesses of the arytenoid cartilages is described. It occurs only in yearling rams on a heavy diet of dry grain, and is thought to be due to wounding of the laryngeal mucous membranes, especially by oat and barley awns. Oedema of the larynx causes partial or complete stenosis, death following in a few days. Efforts at treatment by sulphathiazole *per os*, autogenous bacterins, and tracheotomy have proved ineffective, but the authors consider that dampening the grain may help to prevent occurrence of the disease.—G. B. S. HEATH.

LERENA, E. A. (1943). Reseña sobre la neumo-enteritis de los terneros en la Argentina. [**Pneumo-Enteritis of Calves in the Argentine**].—*Rev. zootéc.* **30.** No. 251. 30–36. **847**

Pneumo-enteritis of calves is very common in the Argentine, and the causal agents most usually found are *Salmonella* and *Bacterium coli.* An outline is given of differential diagnosis, prophylaxis, and treatment. —MILLER WATSON.

JOHANNSEN, A. (1943). Über das Vorkommen von Meningitiden und Meningoencephalitiden bei Allge-

meininfektionen beim Kalb. **[Occurrence of Meningitis and Meningo-Encephalitis in General Infections of the Calf].**—*Skand. VetTidskr.* **33.** 193–206. [In German : English summary]. **848**

Meningitis or meningo-encephalitis was found in 98 of a total of 575 "newborn" calves in which a generalized infection was found at autopsy. It is suggested that failure to recognize the frequent occurrence of meningitis in calves is due to the fact that a careful examination of the central nervous system is not often made. In most cases the calves were merely found dead ; occasionally the animal was said to have been ill for a few days, and in only one case were symptoms observed which suggested involvement of the c.n.s.

The age of affected animals varied from 1–23 days, the average age being about one week. In 82 of the 98 calves with meningitis, there was also polyarthritis. The organisms isolated were :– *Bacterium coli* in 66, paratyphoid in 7, pneumococci in 11, pasteurella in 3, "isocoli" in 2, *Proteus* in 2, *Bact. aerogenes* in 1, and streptococci in 1. No organisms were obtained from five animals. Bacteriological details are not given. The incidence of meningitis in calves which showed *Bact. coli* bacteraemia was 27% (67 of 249), and of animals affected with paratyphoid 18% (7 of 39).

The macroscopic appearances varied from widespread fibrinous deposits covering large areas of the brain to cases in which there was merely hyperaemia of meningeal vessels. The meninges frequently showed ecchymoses or petechiae. Microscopically, the condition was found to be an acute fibrinopurulent meningitis which, in some animals, extended to the brain substance and gave rise to perivascular aggregations of leucocytes and a diffuse infiltration of the nervous tissue.

Infection probably occurs mainly from the intestine (*Bacterium* group of organisms), but navel infection is also a possible route. The finding of meningitis in a one-day-old calf suggests that infection can also occur across the placenta.—E. G. White.

Kurtze, H. (1943). Ueber eine ansteckende Augenkrankheit in einem Rinderbestande. **[An Infectious Conjunctivitis in Cattle].**—*Berl. Münch. tierärztl. Wschr./Wien. tierärztl. Mschr.* May 14th. 148. **849**

An outbreak of disease is described in a herd of 55 cattle, of which 12 animals developed a conjunctivitis, usually of one eye only. Keratitis developed followed by the formation of small abscesses, after which the eye recovered except for the persistence of some corneal opacity. As the young stock escaped the disease, rickettsial infection was considered to be excluded. A diplococcus resembling *Streptococcus bovis* was associated with the condition, and as cows which had received a protective inoculation against the streptococcus escaped infection, the disease was considered to be due to that organism.—U. F. Richardson.

Morris, N. (1943). **Dehydration.**—*Lancet.* **245.** 91–94. **850**

M. gives a useful account of the causes and treatment of dehydration. Clinical dehydration may be produced in three ways :– (1) loss of water containing a lower concentration of Na than body fluids, as in profuse sweating ; (2) loss of electrolyte, either predominantly acid or base, causing alkalosis or acidosis ; (3) shock, due to trauma, toxins or anaphylactic reactions, in which capillary permeability is increased and the internal distribution of the body water is disturbed, although the total volume remains almost the same.

The three main principles of treatment are :– restoration of the water and electrolyte content of the tissues, correction of disturbances of acid-base balance, and maintenance or restoration of the tone of the peripheral circulation. The best fluid for the treatment of dehydration is 0·9% NaCl with the addition of 5–10% glucose. Oral administration is effective only in relatively minor degrees of dehydration : the best route is continuous intravenous drip infusion at a maximum rate of 4 ml. per min. It is unwise to inject glucose saline intraperitoneally or subcutaneously : glucose may be irritating to the tissues, it is an excellent culture medium for bacterial growth, and injection of hypertonic glucose into the peritoneal cavity may cause actual withdrawal of fluid from the blood vessels and tissues.

If capillary permeability has been seriously impaired, as in shock, it is necessary to give a more viscous fluid than saline. Concentrated plasma is best. Gum acacia solution was at one time recommended, but clinical reports of toxic effects and experimental findings suggest that its use is not without danger.—E. G. W.

Beeson, P. B. (1943). **Jaundice Occurring One to Four Months After Transfusion of Blood or Plasma. Report of Seven Cases.**—*J. Amer. med. Ass.* **121.** 1332–1334. **851**

A clinical report of several human cases of what appeared to be transfusion jaundice. The symptoms developed 65–119 days after the first transfusion (and in 33–111 days after the last transfusion) of citrated whole blood or of pooled plasma, and resembled those of catarrhal jaundice. The cases all occurred in adults (age 24–70), but included males and females, whites and negroes.—Alastair N. Worden.

Oliphant, J. W., Gilliam, A. G., & Larson, C. L. (1943). **Jaundice following Administration of Human Serum.**—*Publ. Hlth Rep., Wash.* **58.** 1233–1242. **852**

During 1942, a total of over 11,000 individuals on the Virgin Islands of St. John and St. Thomas was inoculated with the same batch (No. 331) of yellow-fever vaccine containing pooled human serum. The inoculations were carried out in March and April, and by the middle of June it was estimated that 300–500 cases of jaundice had occurred. A survey covering about 10% of the population indicated that 14·7% of vaccinated individuals had developed jaundice, the incidence being greatest in the age groups 20–60. Three cases occurred among 159 individuals said not to have been vaccinated. The average period between vaccination and development of symptoms ranged from 75–103 days among a group of 75 patients from whom reliable information could be obtained.

An experiment was conducted with a total of 189 volunteers from a large institution. Cases of jaundice (30 in all) developed in volunteers among groups receiving the following :– (a) yellow-fever vaccine of the same lot as that employed in the Virgin Islands ; (b) pooled serum from nine cases which had developed the disease on the Virgin Islands ; (c) dried yellow-fever vaccine containing human serum heated for 30 min. at 56°C. ; (d) sera from a severely jaundiced volunteer, from a moderately jaundiced volunteer, and from a volunteer who had not then developed jaundice as a result of treatment (a). Negative results were obtained with post-jaundice serum from a volunteer given treatment (a), with serum from mild cases developed from treatment (a), and from irradiated yellow-fever vaccine.

From these and other observations, it is concluded that the jaundice-producing agent is filtrable and is capable of surviving drying *in vacuo*, storage for long periods at 4°C., and heating at 56°C. for 30 min. Both sexes were susceptible to the experimental infection, during which there was no evidence of transmission by contact. Attempts to transmit the disease to experimental animals or to develop a complement-fixation test were unsuccessful.—Alastair N. Worden.

See also abst. **912** (tetany in pregnancy).

NUTRITIONAL AND METABOLIC DISORDERS

MILLER, W. C. (1943). **Observations on the Feeding of Calves and Young Cattle.**—*Vet. Rec.* **55.** 135–139. **853**

Despite the fact that the vast majority of calves are born free from infection, death rates range from 8 up to about 25% of all living calves born. M. discusses the life-history of the calf, from birth to about six months, in three stages.

Stage (1)—calving and the young calf.—Calving boxes should be provided to avoid calving in the cow-sheds. Colostrum should be fed to calves for the first 4–5 days of life. Meals should be frequent. Whole fresh milk should be given for the first three weeks of life, and milk substitute, gruel, etc., should be given at exactly body temperature. Dilution of milk with clean warm water or lime water is justifiable in the early stages, especially in the case of Jersey and Guernsey calves.

Stage (2)—3–4 weeks to about 3 months.—This is a critical stage during which the fibre-digesting functions of the rumen begin to be established. There should be provided adequate light and air space, an impermeable floor, proper drainage of the floor, and suitable floor surface or bedding to provide comfort. The necessary fibre in a nutritious and readily digested form should be given and the milk feeding should be slowly replaced by other liquid foods and provision should be made for adequate protein and calorific intakes; the necessary minerals and vitamins should also be provided. A soft meadow-hay, with plenty of leaf and a fair legume content, and as green as possible, is ideal, and the hay-net is much more preferable to the hay-rack. Following colostrum, a daily allowance of 1–2 oz. of a good quality cod liver oil is recommended. Small doses (½ oz. twice daily) of yeast often seems to benefit calves of 4–7 weeks which are not thriving.

Stage (3)—from 3 to 6 months.—Cheaper foods are introduced at 3–4 months according to the type and development of the calves, and changes should be gradual. Silage (from 2–3 increasing to from 5–7 lb. daily), well-soaked sugar beet, pulped or fingered roots, green crops, and good hay available are recommended. Mineral supplements should be continued, and attention should be paid to the protein content of the ration. A good variety of foods should be provided at this stage, and adequate, regular, out-of-door exercise is important. From autumn onwards, yards well littered with wheat straw are better than paddocks, and avoid the danger of husk and other parasitic infestations.—A. N. W.

TEMPERTON, H. (1943). **Feeding Horse Chestnuts and Elderberries to Poultry.**—*Nature, Lond.* **152.** 345–346. **854**

Small feeding experiments were carried out using horse chestnuts and elderberries.

The unpalatability of chestnuts whether raw, boiled, or steeped in water before and after cooking, was sufficient to render them quite unsuitable as a poultry food. Birds, even after having had food withheld for 24 hours, refused to eat them in any form.

Elderberries when ripe were eaten readily and no harmful effects were noticed over a period of 30 days. Faeces became an intense purple colour during the experiment, but there was no diarrhoea or diuresis. Owing to the high water content of the berries, it was not considered that any substantial saving of concentrated food would result from their use. Unripe berries were found to be extremely unpalatable.—J. D. B.

CHANNON, H. J., MILLS, G. T., & PLATT, A. P. (1943). **The Action of Amino-acids and Proteins on Liver-fat Deposition.**—*Biochem. J.* **37.** 483–492. **855**

Of 14 pure amino acids investigated, a lipotropic activity could be ascribed with certainty only to tryptophane and to glutamic acid. The activity of tryptophane was small, while that of glutamic acid was confined to the cholesterol-fatty type of liver. Experiments with protein fractions indicated the presence of a lipotropic factor other than cystine, methionine, and tyrosine. This factor could be concentrated in the butanol-soluble amino-acid fraction.—ALASTAIR N. WORDEN.

HARRIS, H. A., NEUBERGER, A., & SANGER, F. (1943). **Lysine Deficiency in Young Rats.**—*Biochem. J.* **37.** 508–513. **856**

Newly weaned piebald rats (mostly males) were provided with a lysine-deficient diet considered adequate in other respects. The further addition of amino acids other than *l*-lysine hydrochloride did not affect the results. The observation that lysine deficiency resulted in a constant body weight was confirmed. The deficient animals also became hypoproteinaemic and showed slightly lowered red cell counts and haemoglobin per unit of blood ratios. Radiological examination revealed decreases in subcutaneous fat, muscle wastage, and decreases in bone calcification as compared with control rats receiving a supplement of lysine, while there were also fewer mitotic figures in the cells of the testes. The picture as a whole is compared with that produced by starvation, and is assumed to result from a general inhibition of protein formation, with subsequent reduction in the growth of some organs at the expense of others, and transference of protein according to a fixed system of growth priorities.—ALASTAIR N. WORDEN.

FOLLIS, R. H., Jr. (1942). **Pathologic Effects Produced by Deficiency of Single Metallic and Nonmetallic Elements.**—*Arch. Path.* **34.** 451–468. **857**

In this review, covering 97 references to original reports, summaries are given of the histopathological changes which have been ascribed to uncomplicated deficiencies of single metallic and non-metallic elements in the diets of animals. Of necessity, most of the information is derived from experiments on laboratory animals including the dog, but tissue changes in deficiencies of potassium in pigs and calves, of magnesium in calves, copper and cobalt in sheep, manganese in chicks, and iodine in sows are mentioned or described in varying detail. Thirteen of the 17 essential elements for animals are considered in turn and only carbon, hydrogen, oxygen and nitrogen are omitted, since deficiency of any one of these elements would quickly result in death. Although valuable information has already been gained on the functional relation of some of these elements to body structures, much knowledge remains to be acquired and, in particular, the need for further histopathological studies of animals maintained on diets deficient in one element or in combinations of elements is clearly shown. The importance of employing purified diets and of ruling out the factor of inanition by paired feeding experiments is stressed.—W. R. MUIR.

FOLLIS, R. H., Jr., ORENT-KEILES, E., & MCCOLLUM, E. V. (1942). **The Production of Cardiac and Renal Lesions in Rats by a Diet Extremely Deficient in Potassium.**—*Amer. J. Path.* **18.** 29–39. **858**

Necrosis of the cardiac muscle fibres and of the tubular epithelium of the kidneys occurred in all rats kept for more than eight days on a synthetic diet extremely deficient in potassium. In the myocardium, necrosis began at small foci which increased in size and number until, after six weeks, they were visible to the naked eye. Leucocytic infiltration took place and the necrosed fibres became replaced by connective tissue. Fewer necrotic foci were seen when scarring had become

extensive ; nevertheless fresh lesions were present after 327 days. Grossly, the kidneys were pale and markedly greater in size and in fresh and dry weight than those of the controls, although the K-deficient animals were smaller in body size. Histological changes were restricted to the convoluted tubules. In the early stages, lipid droplets appeared within the epithelial cells of these tubules. Later, some of these cells became necrotic and others became swollen and detached from the basement membrane to form hyaline masses within the lumina. An increasing number of tubules became dilated and lined with flattened epithelium and, in the final stages, calcified material appeared within the lumina of some tubules. These lesions in the heart and kidney were not due to inanition since they were not observed in control rats whose food intake was restricted to that of K-deficient animals.—W. R. MUIR.

BROWN, C. E. (1943). **Dietary Ulcers of the Esophagus of the Rat.**—*Amer. J. Path.* **19.** 785–795. **859**

Oesophageal lesions, essentially similar to those described by A. M. PAPPENHEIMER & L. D. LARIMORE (1924) developed in young rats which were fed for six months on an unrestricted diet of fresh, finely ground, unpolished Texas rice + 2% cottonseed oil, together with about 1 g. per head daily of fresh carrot, and water *ad lib.* The histopathology of the lesions, which included mucosal ulceration, hyperkeratosis, and dilatation with muscular atrophy and fibrosis, is described.

Similar ulcers were not observed in comparable rats which, after five months on the deficient diet, were provided with supplements of vitamins A, D, E, K, B_1, B_6, riboflavin, nicotinic and pantothenic acids, and 4 g. per head of salt mixture daily. External ulcers (on skin or genitalia), which had developed in some of these rats during the deficiency period, healed after the supplements had been fed.—ALASTAIR N. WORDEN.

I. HOUCHIN, O. B., & MATTILL, H. A. (1942). **The Oxygen Consumption, Creatine, and Chloride Content of Muscles from Vitamin E-Deficient Animals as Influenced by Feeding α-Tocopherol.**—*J. biol. Chem.* **146.** 301–307. **860**

II. HOUCHIN, O. B., & MATTILL, H. A. (1942). **The Influence of Parenteral Administration of α-Tocopherol Phosphate on the Metabolic Processes in Dystrophic Muscle.**—*Ibid.* 309–312. **861**

III. HOUCHIN, O. B. (1942). **The in vitro Effect of α-Tocopherol and its Phosphate Derivative on Oxidation in Muscle Tissue.**—*Ibid.* 313–321. **862**

I. Comparative analysis of the sliced muscle of 59 normal and vitamin E deficient rabbits, rats, and hamsters showed that dystrophic muscle from the test animals had a much higher oxygen consumption, somewhat lower creatine content, and higher chloride concentration than the muscle from control animals. The oxygen consumption of dystrophic hamster muscle was 250% of the normal, and oral administration of α-tocopherol (synthetic vitamin E) to dystrophic hamsters lowered the muscle oxygen consumption towards the normal within 27 hours, without affecting the chloride content. The high initial oxygen uptake of the muscle of vitamin E-deficient rabbits was depressed within ten hours to the normal figure by α-tocopheryl acetate given orally, without significant alteration in either the creatine or chloride content.

II. Oxygen uptake and creatine and chloride estimations were made of muscle samples removed, immediately and at suitable intervals after a slow intravenous injection of α-tocopheryl phosphate, from a normal rabbit and several dystrophic rabbits during a series of multiple biopsy experiments. Results showed that the parenteral administration of α-tocopheryl phosphate reduced the high oxygen consumption of dystrophic rabbit muscle to practically a normal level in four hours ; that there was a sharp decline in muscle creatine content during the first two hours, followed by a slight rise to a figure still far below the initial, already low, dystrophic level after four hours ; and that the chloride concentration, not immediately influenced by tocopherol, remained high throughout. The result obtained for the muscle creatine level was the opposite of the final effect of tocopherol on the muscle creatine of rabbits cured of muscular dystrophy. The author considered these data to indicate the intimate relation of α-tocopheryl phosphate with the complicated enzyme systems involved in the physiology of muscle tissue.

III. *In vitro* comparisons were made of the succinoxidase activity (rate of oxygen consumption) of the thigh muscles of normal and vitamin E deficient rabbits, hamsters, and rats, and of the effect of the addition of α-tocopherol and of α-tocopheryl phosphate. The succinoxidase activity of dystrophic hamster muscle was found to be 160% above that of normal muscle, corresponding roughly with the degree of dystrophy. The reduction of the succinoxidase activity of dystrophic muscle by 59% by the addition of α-tocopheryl phosphate agreed with the decrease in the oxygen uptake of muscle slices produced by α-tocopheryl phosphate *in vitro* and *in vivo*. α-tocopherol alone proved to be without effect on the oxygen uptake due to succinoxidase activity.

Mincing and homogenizing lowered the oxygen consumption of both normal and dystrophic muscle to identical figures.

There is a short discussion of the possible rôle of α-tocopheryl phosphate in the metabolism of skeletal muscle.—R. O. MUIR.

WINTROBE, M. M., ALCAYAGA, R., HUMPHREYS, S., & FOLLIS, R. H., Jr. (1943). **Electrocardiographic Changes Associated with Thiamine Deficiency in Pigs.**—*Johns Hopk. Hosp. Bull.* **73.** 169–195. **863**

A detailed description is given of the pronounced electrocardiographic changes which develop in pigs deprived of vitamin B_1 by methods already described [see WINTROBE *et al.*—*V. B.* **11.** 627 and **13.** 297]. The changes included bradycardia (which to a lesser degree developed also as a result of inanition alone), a prolonged PR interval, second degree auriculo-ventricular block, abnormalities in the P waves, inversion of T_4, nodal and ventricular premature beats, auriculo-ventricular dissociation, and complete block with ectopic ventricular rhythm and auricular fibrillation. The original should be consulted for details, which include many illustrations.—ALASTAIR N. WORDEN.

RALLI, E. P., & GRAEF, I. (1943). **Stimulating Effects of Adrenalectomy on Hair Growth and Melanin Deposition in Black Rats Fed Diets Adequate and Deficient in the Filtrate Factors of Vitamin B. With a Note on Effect of Diet on Post-Operative Survival.**—*Endocrinology.* **32.** 1–12. **864**

This work was initiated in view of statements in the literature that deficiency of vitamin B complex "filtrate factors" resulted in atrophy and necrosis of the adrenal cortex of rats, as well as in greying of the fur of black and brown animals. Rats were maintained on basal vitamin B complex deficient diets supplemented with vitamins B_1, B_6 and riboflavin, but not with pantothenic acid or other filtrate factors. Coat changes were observed which were strikingly reversed by bilateral adrenalectomy. The changes were best observed in partially shaved animals, and coloured photographs illustrating the various conditions are included. Adrenalectomized animals receiving a com-

plete diet survived as long as 96 days unless deprived of adequate amounts of sodium chloride, whereas in animals receiving the filtrate factor deficient diet, the average survival time was only 18 days.—A. N. W.

RAY, S. N. (1942). **Hypomagnesaemia in Heifer Calves.** —*Indian J. vet. Sci.* **12.** 204–212. **865**

In experiments on the effect on heifer calves of protein and vitamin A deficient rations, R. observed "fainting fits". The animals fell down suddenly, with limbs stiff, legs rigid, and eyes half closed. There was no struggling or movement. Breathing was laboured with occasional foaming at the mouth. Temperature was normal. Insensibility usually lasted for 5–6 min. After the attack, the animals rose of their own accord, but continued to show marked excitement for some time. Food intake was normal.

The possibility of these attacks being due to deficiency of vitamin A and calcium was excluded. Blood examination showed a normal level of Ca but a definitely low level of magnesium. The Mg level fell considerably during the attacks, but rose immediately afterwards. Feeding 4 oz. of magnesium carbonate per day for seven days raised the blood Mg but did not improve the condition, whereas fresh hay quickly prevented the onset of attacks. It is probable that, in addition to the higher proportion of Mg, fresh hay contains some substance which had a direct curative effect on these symptoms and improved Mg utilization.

R. points out that the Mg requirement of Indian heifer calves is more than the requirements reported by European and American workers.—N. D. KEHAR.

See also abst. **912** (tetany in pregnancy).

PHYSIOLOGY AND ANATOMY

CLARK, E. R., & CLARK, E. L. (1943). **Caliber Changes in Minute Blood-Vessels Observed in the Living Mammal.**—*Amer. J. Anat.* **73.** 215–250. **866**

During the past 14 years, the authors and their colleagues in the Anatomy Department of the University of Philadelphia have made an extensive series of observations on the peripheral blood vessels in the living animal by inserting transparent chambers and windows in the ears of rabbits and dogs. The present article is, in part, a review of previous work and it also describes further experiments dealing especially with regeneration of blood vessels and their acquisition of contractility. Newly formed vessels were found unable to contract until they were innervated by growth of new sympathetic nerves. In contrast to amphibia, mammalian capillaries and venules are not actively contractile. Changes in calibre in these vessels are brought about passively due to changes in blood flow. The only vessels which are actively contractile are arteries, arterioles, arterio-venous anastomoses, and a few large veins: contraction is brought about by a neuromuscular mechanism. The reasons which have led many workers to consider that capillaries are actively contractile are critically discussed and the authors' own views are supported by a number of illustrations.—E. G. WHITE.

HENDERSON, YANDELL. (1943). **Tonus and Venopressor Mechanism: The Clinical Physiology of a Major Mode of Death.**—*Medicine.* **22.** 223–249. **867**

This paper is largely a summary of the author's work on the vasomotor mechanism during the past 40 years. The main thesis is that the muscles act as "tonic booster pumps" which are of considerable importance since they pump blood through the veins to the right heart. H. contends that it is this venopressor mechanism, and not the heart itself or the vasomotor system as ordinarily considered, which in a large proportion of deaths ultimately fails and so brings the circulation to a standstill. The maintenance of muscle tone is important in ensuring an adequate venous return. The main function of the vasomotor system is to adjust the arterial pressure and the distribution of blood to various tissues: the main function of the venopressor mechanism is to adjust the volume of the venous return. When circulatory failure occurs in the absence of haemorrhages, the blood is held in the veins and is not returned to the heart.—E. G. WHITE.

HOLLINSHEAD, W. H. (1943). **A Cytological Study of the Carotid Body of the Cat.**—*Amer. J. Anat.* **73.** 185–213. **868**

It is generally agreed that the carotid body functions as a chemoreceptor and a study of its cytology may help to elucidate the relation between structure and function. H. has made a detailed cytological study of the carotid body in the cat, in which species it is compact and easily located. The syncytial arrangement described by various workers could not be confirmed and the carotid body cells showed no evidence of either Nissl substance or neurofibrils which would suggest an affinity with neurons. Cytoplasmic fuchsinophilic granules were present which were not mitochondria and failed to give the peroxidase reaction. Although the composition of the granules was not elucidated, H. considers that they are probably concerned in initiating the chemoreceptor reflexes.—E. G. WHITE.

ROTHMAN, S. (1943). **The Principles of Percutaneous Absorption.**—*J. Lab. clin. Med.* **28.** 1305–1321. **869**

This is a review, covering the period 1920–41, of published work dealing with absorption through the skin. Only a few of the subjects dealt with in this very useful article can be indicated within the scope of an abstract.

The skin of invertebrates, fish, and amphibia is capable of absorbing water; the skin of mammals is generally considered not to absorb water except possibly traces passing through the skin pores. The generalization that lipoid-soluble substances are absorbed through the skin whereas lipoid-insoluble ones are not, is true almost without exception. Substances which are soluble both in lipoids and water, *e.g.* alcohols, aldehydes (chloral hydrate), and ketones (acetone), seem to be absorbed the most readily.

Phenols easily penetrate the skin, provided that they are not applied in concentrations sufficient to have a caustic effect. In the latter case, their penetration is lessened, probably because of coagulation of the proteins in the skin. This applies also to some salts of heavy metals which in concentrated solution have a caustic action. Salicylic acid and its esters are readily absorbed. Lipoid-soluble lead salts penetrate the skin to a very limited extent, probably not sufficiently to cause lead poisoning.

Sex hormones, vitamins A and D, and carotene are very readily absorbed. Reports suggesting that the lipoid-insoluble ascorbic acid and thiamin chloride are absorbed have not so far been confirmed.

Free alkaloid bases (nicotine, strychnine, opium alkaloids) are easily absorbed, whereas salts of alkaloids are absorbed hardly at all.

Animal and vegetable fats and oils are readily absorbed through the pilo-sebaceous apparatus. Mineral fats and oils penetrate less readily.

Gases are easily absorbed, with the exception of carbon monoxide which is lipoid-insoluble.

Absorption is not necessarily improved by incorporation of the substance in a fat or fat solvent base: it

has, in fact, been reported that oestrogens are absorbed more readily from aqueous solution than when dissolved in an oily vehicle.

Fat solvents such as alcohol, ether, and chloroform increase absorption mainly by increasing skin permeability. For example, previous application of a fat solvent to the skin will increase the subsequent absorption of aqueous solutions of strychnine.

The virtue of ointment bases is mainly mechanical. Rubbing causes penetration of the ointment into hair follicles and absorption is increased in these sites. Incorporation in an ointment of substances which would not otherwise be absorbed is of no value. Sodium salicylate, for instance, is not absorbed no matter what base is used as a vehicle. The addition of cholesterol to a base does not ordinarily increase absorption. Various recently introduced vehicles incorporating "wetting agents" appear greatly to enhance absorption through the skin of man and animals.

The use of electrophoresis may enable absorption of substances to which the skin is normally impermeable, *e.g.* salts of adrenaline or strychnine. Absorption occurs through the skin appendages and not through the skin itself.—E. G. WHITE.

ELIJAH, H. D., & TURNER, C. W. (1942). **The Weight and Thyrotropic Hormone Content of the Anterior Pituitary of Swine.**—*Res. Bull. Mo. agric. Exp. Sta.* No. 357. pp. 27. **870**

Pituitaries were obtained from representative animals of three different strains or lines of Black Poland China pigs which are being raised at Missouri as part of the work of the Regional Swine Breeding Laboratory. A brief description of the anatomy of the swine pituitary is given, and it is stated that in this species it is much more easily removed than in the case of the ox. The gland is more or less suspended from the tuber cinereum by the cartilaginous diaphragm in the sella turcica. The anterior lobe lies next to the cerebrum, with the posterior lobe underneath as the mid-dorsal part of the gland. The stalk is very short, so that the posterior lobe is attached almost directly to the brain. A cone of Wulzen was never demonstrated during histological examinations.

The average weight of the gland at birth was approximately 25 g., while at six months of age it was 250 g., and at full maturity about 800 g. The ratio of pituitary weight to body weight decreased rapidly up to about 65 lb. body weight, and less rapidly afterwards. In the strains studied, gilts had heavier pituitaries than had boars. There was, however, much individual variation.

The thyrotropic hormone content was determined by the chick thyroid method of BERGMAN & TURNER (1939). In the case of gilts, the average activity, expressed as chick units per g. of fresh anterior pituitary tissue, was found to be: 44 at 31 lb. body weight (52 days of age), 56 at 209 lb. (197 days), 70 at 300 lb. (261 days), and 57 at 450 lb. (458 days).

Values for boars were similar, but in castrated males they were substantially less. There was a positive correlation between rapid growth and high thyrotropic hormone concentration.—ALASTAIR N. WORDEN.

BUIDE, R. (1942). Las glándulas tiroides y paratiroides en algunas especies domésticas. [**The Thyroid and Parathyroid Glands of Some Domestic Animals (Horse, Ox, Sheep, Dog, and Cat)**].—*Inst. Anat., Fac. Agron. Vet., Univ. B. Aires.* **1.** No. 5. pp. 60. **871**

B. describes the development, gross and microscopic anatomy, and blood and nerve supply of the thyroid and parathyroid glands of the horse, ox, sheep, dog, and cat.

Particular attention is paid to these organs in the horse. In this animal the external parathyroids may be in direct contact with the thyroids or they may be actually encased in the thyroid parenchyma, groups of parathyroid cells existing among the thyroid follicles. In other cases, the parathyroid is connected to the thyroid by means of a glandular peduncle, which has its origin beneath the thyroid capsule. In still other cases, the parathyroids may be situated on the medial surface of the thyroid, adjacent to the trachea, or well separated from the thyroid by connective tissue. Internal parathyroids exist in the horse, but they are not present in every case, and their situation within the thyroid varies considerably.—ISOBEL W. BURTON.

GRAFFLIN, A. L. (1942). **Histological Observations upon the Thyroid Gland, Parotid Gland and Kidney of the Indian Elephant.**—*J. Morph.* **70.** 189–208. **872**

E. carried out histological studies on the thyroid, parotid, and kidney of two adult female Indian elephants (30 and 70 years old) from the Boston Zoological Garden. Special attention was paid to the characters of yellowish pigment granules present in variable numbers in the follicular epithelium of the thyroid, the "striated secretory ducts" of the parotid, and the glomerular epithelium, distal tubules, and collecting ducts of the kidney. These granules stain with Sudan III: those present in the thyroid and parotid show a yellow or brownish-yellow fluorescence, whereas the kidney granules are non-fluorescent. It is considered that the granules represent "wear-and-tear" pigment (*Abnutzungspigment*) which has been described in these situations in other species.—E. G. WHITE.

DUDLEY, J. (1942). **The Development of the Ultimobranchial Body of the Fowl, Gallus Domesticus.**—*Amer. J. Anat.* **71.** 65–97. **873**

The final fate of the ultimobranchial bodies in mammals is still disputed: some believe that they degenerate, others contend that they are converted into thyroid tissue. D. has made a detailed study of the development of these bodies in the fowl. Of the six branchial pouches in the chick, the fifth and sixth are both vestigial, the fifth being only transitory, and the sixth giving rise to the ultimobranchial bodies. These bodies consist of abundant fine branching strands of polygonal cells and a stroma of reticular tissue and blood vessels. The blood supply comes from the common carotid and the jugular vein. Innervation is from the vagus and there are also branches from the sympathetic and recurrent nerves. The parenchyma may give rise to one or more accessory parathyroids. From the tenth day of incubation and continuing until at least the first months after hatching, the bodies produce eosinophiles. Lymphocytes increase in most areas after hatching and give an appearance suggesting thymus tissue. After hatching, cavities appear which contain cellular debris: they are not considered an indication of secretory activity.—E. G. WHITE.

See also abst. **797** (endocrines in anaphylaxis and allergy).

POISONS AND POISONING

KEHOE, R. A., CHOLAK, J., HUBBARD, D. M., BAMBACH, K., & MCNARY, R. R. (1943). **Experimental Studies on Lead Absorption and Excretion and their Relation to the Diagnosis and Treatment of Lead Poisoning.**—*J. industr. Hyg.* **25.** 71–79. **874**

The lead intake and output of two human subjects

was studied over a long period, during which 2 mg. soluble Pb in addition to that contained in a normal diet were taken daily by one subject for 23 lunar months and elimination of Pb was studied for 16 months after cessation of Pb administration; the other subject took 1 mg. soluble Pb over a period of 40 lunar months. No symptoms of illness, no lead line, and no change in the numbers of stippled erythrocytes in the peripheral circulation was observed. The concentration of Pb in the blood and urine increased promptly and continued to increase gradually during the period of administration. As the daily dosage of Pb was constant, the increase in the rate of urinary excretion must have been an expression of the quantity of Pb accumulating in the tissues which constituted an increasing source for Pb excretion. Results also demonstrated that there was no appreciable elimination of Pb from the tissues by way of the alimentary tract after cessation of Pb administration. Out of 1,419·33 mg. Pb that were ingested by the subject taking 2 mg. Pb daily, 1,309·26 mg. were eliminated from the body, while approximately 110 mg. or about 8% of that ingested was retained in the body during the period of 23 months at a rate of about 5 mg. per month. The Pb accumulation in the two subjects, although occurring at very different rates, appeared continuous and very regular. The observations show that a large proportion of the Pb actually absorbed into the body is excreted by way of the kidney and it is apparent that the extent of Pb exposure and absorption determines the magnitude of urinary Pb excretion.

A study of the influence of dietary changes on alimentary Pb absorption showed that any variations were insignificant and that Pb metabolism is very stable and, in fact, so stable that it is not importantly influenced by gross changes in the acid-base equilibrium or in the Ca and P metabolism of the body.—R. A.

MELLO, E. M. M., & FERNANDES, J. S. (1941). Contribução ao estudo das plantas tóxicas brasileiras. **[Poisonous Plants of Brazil].** pp. 106. Rio de Janeiro: Ministério da Agricultura. [8vo] **875**

The first part of this report deals with three plants which have hitherto been regarded as toxic, viz, *Rhynchosia phaseoloides*, *Hamelia patens*, and *Palicourea nicotianaefolia*. All three were proved to be non-toxic to animals. The first contains hydrocyanic acid, but in negligible amounts. The others do not contain any important toxic elements.

The second part of the report deals with *Pseudocalymma elegans*, which was proved to be toxic to cattle, by virtue of an alkaloid or a mixture of an alkaloid and a glucoside, acting upon the nervous and vascular systems. Lesions may be so severe as to cause death within a few days of ingestion of the plant.—I. W. B.

TEL'TSOV, A. I. (1940). O gisto-patologicheskikh izmeneniyakh v vozvratnykh i bluzhdayushchikh nervakh i myshtsakh gortani pri latirizme loshadeï. **[Lesions in the Recurrent and Vagus Nerve at the Larynx in *Lathyrus sativus* Poisoning in Horses].**—*Sovyet. Vet.* No. 11/12. pp. 83–86. **876**

T. studied the morphological changes of the vagus and recurrent nerves as well as alterations in the muscles of the larynx due to poisoning by *L. sativus*. Several photomicrographs illustrate the histological changes occurring in the affected tissues. The nerve fibres of the vagal nervous system undergo degenerative changes such as vacuolation, etc., particularly in the peripheral regions of the nerves. These changes, which develop quite irregularly, were specially marked in the preterminal sections of the left recurrent nerve. In the liver and spleen, a characteristic and profound inflammation of the tissues was observed. The history of the disease in a few horses is given in considerable detail.

The poisonous elements in *L. sativus* appear to be produced by the plant in connexion with a special type of soil, cultivation, and climatic conditions.—E. R. P.

SASTRY, M. R. S., NAYAR, C. K. V., RAMASWAMY, R. & VENKATACHALAM, K. (1943). **Investigations on the Toxicity of *Crinum defixum* Ker-Gawl, I.**—*Indian J. vet. Sci.* **13.** 65–69. **877**

The authors fed the leaves and bulbs of *C. defixum* to dogs and observed the following effects about 15 min. after administration:—severe gastro-intestinal irritation, asphyxiation, and congestive failure of the right side of the heart with petechial haemorrhages in various internal organs. The toxic principle (not yet isolated) which is only partially soluble in water, is contained in the bulbs and not in the leaves. The M.L.D. of the bulbs is 1·75 g. per kg. body weight. The toxic effects were cumulative.—N. D. KEHAR.

—. (1941). **Mushroom Poisoning.**—*M*[*ich*]. *S*[*t*]. *C*[*oll*]. *Vet.* **1.** 88. **878**

Symptoms of severe toxaemia were reported in several cows, three of which died. After P.M. examinations, a diagnosis of mushroom poisoning was made, based on the fact that large quantities of fermenting mushrooms were found in the rumen and that mushrooms [species not stated] were found growing abundantly in the pastures. The only gross lesions observed were a few petechial haemorrhages in the heart.—R. A.

PILLAI, M. R. (1943). **The Evil Effects of Hand-Feeding Cattle with Jonna Straw.**—*Indian vet. J.* **19.** 301–306. **879**

P. describes the method of hand feeding cattle with Jonna (jowar—*Andropogon sorghum*) straw by villagers in parts of Madras and the ill effects of this. Besides impaction and other digestive troubles, the fodder is liable to produce injuries of the tongue and pharynx and oesophageal obstruction. 178 animals were treated for these conditions in three years.

—M. K. SREENIVASAN.

WIRTH, D. (1943). Bienenstichvergiftung beim Pferd. **[Bee-Sting Poisoning in Horses].**—*Wien. tierärztl. Mschr.* **30.** 129–134. **880**

A detailed description is given of the symptoms exhibited by a three-year-old horse which, with another animal, had been attacked by bees. After being attacked, the animal became greatly excited and showed every sign of nervous hypersensitivity, followed by collapse and subsequent slow recovery. Swelling of the subcutaneous tissue was extensive and was associated with an appreciable amount of necrosis. Whilst the companion animal died within 24 hours, this animal survived to make a slow recovery lasting 5–6 weeks. Even after this time, however, it had little capacity for work and remained for many months in a depressed state.

Some 250 stings had been sustained and the symptoms were severe. Methaemoglobin quickly appeared in the urine following the attack and bilirubin in the bloodstream gave the already congested conjunctiva a jaundiced appearance. Marked changes in the white blood corpuscles are also recorded.

From a brief review of the literature referred to, it appears that of the domestic animals the horse is most prone to attack.—N. S. BARRON.

HIGGINS, G. M. (1943). **Toxic Effects of Promin (Sodium P,P′-Diaminodiphenylsulfone-N,N′-Didextrose Sulfonate) on the Erythrocytes of Guinea Pigs.**—*Amer. J. med. Sci.* **205.** 834–841. **881**

The effect of oral promin therapy on the red blood corpuscles of normal g. pigs was studied throughout a 21-day drug administration period and a further 21-day

recovery period. Four groups of five animals were used: those in group I received 100 mg. promin per day, those in group II 200 mg. per day, and those in group III 300 mg. per day, while the group IV animals served as controls.

The toxicity of the drug was indicated by the fact that, at the end of the drug administration period, two animals in group II and 3 in group III were dead, while the direct effects on the r.b.c. of the treated animals were manifested as follows:—presence of sulphaemoglobin, methaemoglobin, and an unidentified pigment in the cells, changes (*e.g.* crenation) in the surface membranes, anaemia of haemolytic type associated with an increase in the number of reticulocytes, increase in r.b.c. volume, and darkness and enlargement of the spleen. The drug did not apparently induce any permanent damage of bone marrow, and regeneration of r.b.c., indicated by reticulocytosis, macrocytosis and polychromatophilia, was found to proceed when there was continuous administration of large amounts.

—J. LOCHIEL MCGIRR.

FAIN, A. (1942). Accidents toxiques et résultats après une seule injection de Bayer 205 administrée préventivement dans un ancien foyer de trypanosomiase. **[Toxic Results of a Single Injection of Bayer 205 Used in the Prevention of Trypanosomiasis in an Endemic Area].**—*Rec. Trav. Sci. méd. Congo Belge.* No. 1. pp. 137–144. **882**

A description of work involving the treatment of the 4,500 inhabitants in an old, but still active, centre of sleeping sickness; the intention was to give quarterly injections of belganyl (a form of Bayer 205) at a dose of 0·025 g. per kg. body weight, but war conditions prevented more than one injection being given. Within a few minutes of the injection, many patients showed mild or severe symptoms of shock, death resulting in one case. Within the next 24 hours, a febrile reaction occurred in most patients and this was associated with a cutaneous hyperaesthesia affecting the hands and feet. About half the treated people developed some albuminuria, but no clinical symptoms were exhibited. About a week after injection, desquamation of the skin of the hands and feet sometimes occurred.

Twelve fresh cases of infection were detected in the area on visits during the next three quarters. It is suggested that ten of these were actually infected before the time when the belganyl injections were given and that two contracted infection later. A small quantity of Bayer 205 gave similar results to those given by belganyl.—U. F. RICHARDSON.

LONGCOPE, W. T. (1943). **Serum Sickness and Analogous Reactions from Certain Drugs Particularly the Sulfonamides.**—*Medicine.* **22.** 251–286. **883**

A valuable review which attempts to deal with the whole subject of serum sickness. Knowledge of serum disease has been acquired almost exclusively from man, but the antigens responsible consist largely of the proteins which are present in serum from horses immunized against a variety of toxins and bacteria, or in such antisera in concentrated and refined form. Blood serum contains at least four serologically distinct species-specific proteins and it seems obvious from modern analyses that, when whole serum from normal animals is injected into human beings, the fluid contains several specific antigens. Furthermore, when immune sera are employed the antigenic properties may be distorted from the normal by the predominance of one protein fraction over another, or by the appearance of fractions not readily demonstrable in normal serum. There have been statements to the effect that bovine serum is less likely to be antigenic for human beings than horse serum, and that fowl serum, freed from fibrinogen, does not produce serum sickness. Attempts are being made, but so far with little success, to prepare from bovine serum a purified albumin fraction which will prove non-antigenic.

The position is complicated still further by the fact that reactions identical with those of serum sickness are occasionally observed in man following the injection of homologous serum. [Reactions to the injection of homologous distemper serum are sometimes observed in dogs.] The cause of such reactions is obscure.

The work of LANDSTEINER and others has demonstrated finally that the specificity of antigens depends upon chemical constitution, and it has even been shown that g. pigs may be sensitized to a pure, unconjugated chemical. There is adequate explanation of the sensitivity of human beings to pure chemicals, *e.g.* in "contact dermatitis". It is supposed that repeated contact with, say, formalin, leads eventually to the formation of an antigen constructed from formalin and body protein; subsequent contact with formalin leads to an allergic reaction.

L. provides an extended discussion of systemic reactions following the administration of certain drugs, notably the sulphonamides: he points out that these reactions differ in that specific antibodies have not so far been demonstrated in the serum, and that skin reactions to the specific drug are rarely obtained. The pathology, clinical features, and treatment of serum sickness and analogous conditions are also reviewed.

It is mentioned that typical serum sickness has been said to occur in calves, but the reference is not cited.—ALASTAIR N. WORDEN.

—. (1943). **The Farm Livestock Emergency Service. Duties of Veterinary Surgeons and Animal Stewards when Bombs Containing Phosphorus or Other Poisonous Substances have been Dropped During an Air Raid.**—*Vet. Rec.* **55.** 167. **884**

The enemy has made use of phosphorus as a coating for pieces of rubber and other inflammable material, or mixed it with inflammable liquids; contaminated material should be burned or buried. Fires may result from the spontaneous combustion of such material, at varying intervals after it has fallen depending upon the prevailing weather conditions, or as a result of friction from boots or hoofs. Poisoning following the ingestion of contaminated foodstuffs or water may also occur.

Unignited phosphorus exposed to air gives off fumes with a characteristic smell and glows with a greenish tinge which can only be seen in darkness. Phosphorus smoke in the open air is not markedly poisonous, but respirators should be worn in its presence, and in enclosed spaces. When contaminated material is handled, rubber gloves should be worn. Leather gloves give some protection but if bare hands are used they must be kept wet.

First-aid treatment of phosphorus burns consists of swabbing with water and covering with bicarbonate of soda, which should be worked up into a paste and then washed off, the part being finally swabbed with 1% copper sulphate solution. This routine should be continued for 20–30 min. The area should be allowed to dry and then, if slight friction causes fire, repeat treatment. After-treatment is as for ordinary burns—greasy dressings being avoided.—H. E. BYWATER.

—. (1943). **The Treatment and Disposition of Stockyards Animals Subjected to Gas Attacks.**—*J. Amer. vet. med. Ass.* **103.** 80–81. **885**

Recommendations are in accordance with those published in Great Britain, save that a 5% solution of

potassium permanganate is advised for the decontamination for vesicants. This agent is well known as a decontaminating agent, but in Great Britain it is considered that other agents are preferable.—H. E. BYWATER.

—. (1943). **War Office. Medical Manual of Chemical Warfare, 1943.** pp. 88. London: H.M. Stat. Off. [8vo] [2s. 6d.] **886**

This is a revised edition of the 1940 issue [see *V. B.* **11.** 805.] and although it is a thinner volume it contains additional material. In the chapter on vesicant gases, greater emphasis is laid on the possible systemic effects of mustard gas poisoning and the work of MANN & PULLINGER [see *V. B.* **13.** 260.] is included. Instructions for the preventive treatment after contamination with mustard gas are revised.—R. ALLCROFT.

THERAPEUTICS AND DISINFECTION

—. (1943). **Sixth Addendum to the British Pharmacopoeia 1932.** pp. viii+41. London: Constable & Co. Ltd. [8vo] [5s.] **887**

This contains a number of additions to the pharmacopoeia including:—several vitamin preparations, *viz*, riboflavin, nicotinamide and two substances with vitamin K actions—menaphthone and acetomenaphthone (the latter, being less irritant, can be administered orally); stilboestrol; chloroxylenol (the antiseptic in Dettol); dithranol, used in the treatment of psoriasis and other skin conditions as an alternative to chrysarobin. A preparation of wool alcohols which must contain not less than 28% of cholesterol is included and a number of ointments which make use of it are given. A method for sterilization is added to the monograph for sulphanilamide.—J. M. ROBSON.

HURST, H. (1943). **Permeability and Molecular Constitution as Factors in Drug Action.**—*Nature, Lond.* **152.** 292–296. **888**

Recent work on molecular reactivity in monolayers has provided a very valuable guide to the factors which influence specific drug reactivity in pharmacological systems. In the present article, an attempt is made to correlate existing pharmacological data and theories of drug action with experimental evidence which has resulted largely from a study of the mode of action of insecticides.

The fundamental components of a pharmacological system may be resolved into (1) the biological system, (2) the drug, and (3) the carrier. The insect cuticle framework consists of a heterogeneous system of protein, lipoid, chitin, and other components, and although the nature and relative distribution of these components vary considerably in different species, they are all of the same fundamental pattern, upon which drug access may be explained.

Physico-chemical factors which influence drug access through insect cuticle are, the molecular structure and degree of ionization of the drug, and the physical nature of the carrier. Drug reactivity may increase, decrease, or remain relatively constant as a homologous series is ascended according to the mode and site of application.

Drugs which show the effects of induced penetration by fat solvents include feebly dissociating alcohols, ketones, fatty acids, amines, and phenols. The drugs penetrate as unionized molecules.

The carriers which facilitate drug access include a wide range of aliphatic and aromatic fat solvents. Generally, carrier activity decreases with increase in capillary activity.—W. MOORE.

MEZEY, K. (1942). Estudio experimental de la acción diurética del Axonopus scoparius (Micay). [**Diuretic Action of** *A. scoparius*].—*Rev. Med. vet., Bogotá.* **11.** 559–564. **889**

M. describes the diuretic action of an aqueous extract of *A. scoparius* on rabbits and dogs. In rabbits receiving 0·06 g. per kg. intravenously of the extract, there was an increase up to 20–30% in the amount of urine excreted. In dogs, smaller doses produced a temporary rise in blood pressure with an increase in the amount of urine excreted.—MILLER WATSON.

MOZGOV, I. E., & ZHMURIN, M. G. (1940). Slabitel'noe deĭstvie polevovo v'yunka. [**Purgative Action of** *Convolvulus arvensis*].—*Sovyet. Vet.* No. 11/12. pp. 53–57. **890**

This plant has been used as a domestic remedy for wounds and as a purgative. As a result of various feeding experiments on mice, cats, dogs, piglets, and horses, it was concluded that the plant, the active component of which is convolvulin, may be used as a purgative for all species of animals. Extracts of the roots contain more active principle and are less toxic than the stalks. The toxic dose of the extract of the root is approximately three times higher than the therapeutic dose. After drying and storage the toxic, but not the purgative, properties are diminished. The action of the plant is similar to that of aloes and podophillin, but it is less toxic.—A. MOLDAWSKY.

FAULKNER, G. H. (1943). **Bactericidal Action of Oestrogens.**—*Lancet.* **245.** 38–40. **891**

Stilboestrol produced a bactericidal action *in vitro* on Gram-positive cocci, *Corynebacterium diphtheriae*, and *Neisseria catarrhalis*. The minimal lethal concentrations varied from 1 : 5,000 to 1 : 500,000. No inhibitory action on the Gram-negative bacilli has been observed. In one experiment, tubercle bacilli were killed by incubation *in vitro* with stilboestrol 1 : 5,000. Hexoestrol also showed bactericidal properties. No effects were obtained with other oestrogens tested (oestrone, oestradiol, diethoxytriphenyl bromo ethylene). The bactericidal activity of stilboestrol is reduced in the presence of serum.—J. M. ROBSON.

WAKSMAN, S. A., & HORNING, E. S. (1943). **Distribution of Antagonistic Fungi in Nature and their Antibiotic Action.**—*Mycologia.* **35.** 47–65. **892**

Methods are described for isolating fungi antagonistic to bacteria, from soils, manures, composts and other natural substrates. A large number of these fungi were isolated and divided into nine distinct taxonomic groups some of which, *viz*, those belonging to the genus *Aspergillus* and the green *Penicillium* were particularly active, while others such as members of the genera *Fusarium* and *Cephalosporium* had very little activity; different strains of various fungi were found to vary considerably in their antibiotic activity. Factors such as temperature, length of incubation, and composition of the culture media were found to have an important influence on the production of antibacterial substances by various fungi.

Details are given of the preparation of an antibiotic substance designated as "fumigacin" from a strain of *A. fumigatus* which was found to be active against various bacteria. [See also *V. B.* **13.** 226, abst. 1513.]
—R. ALLCROFT.

WELCH, A. D., MATTIS, P. A., LATVEN, A. R., BENSON, W. M., & SHIELS, E. H. (1943). **Sulfamerizine (2-Sulfanilamido-4-Methylpyrimidine). I. A Comparison of Sulfamerizine with Sulfadiazine on the**

Basis of Absorption, Excretion and Toxicity.—*J. Pharmacol.* **77.** 357–391. **893**

Experiments on animals and man show that sulphamerazine is more rapidly absorbed than sulphadiazine; it produces a high concentration in the blood with a smaller dose than sulphadiazine and is more slowly excreted by the kidney in a form more soluble than sulphadiazine in neutral or acid urine. The acetyl derivative is more soluble than sulphamerazine and more soluble than acetyl sulphadiazine in urine at a pH of 7 or less. Sulphamezathine is as rapidly absorbed as sulphamerazine, but it is more rapidly eliminated, the rate being intermediate between that for sulphamerazine and that for sulphadiazine.

Prolonged administration to monkeys indicates that sulphamerazine and sulphadiazine have similar toxicities when a comparison is made on the basis of the concentration in the blood. Studies in chickens show that sulphamerazine has no greater potentiality for the production of neuropathological changes than has sulphadiazine. It is suggested that one or two doses of sulphamerazine daily may be sufficient to maintain a safe and adequate concentration of sulphonamide in the blood and other tissues. The rapidity of absorption suggests that intravenous injection may not be necessary when it is desired to produce an adequate blood concentration quickly.—J. M. Robson.

Clay, A. C. (1943). **Chemotherapy of Intestinal Infections Treated with Sulphonamide Compounds.**—*Brit. med. J.* July 10th. 35–36. **894**

Of 237 cases of bacillary dysentery, 140 were given sodium sulphate (no specific chemotherapy), 83 sulphaguanidine, and 50 sulphanilamide (dosage half the quantity of sulphaguanidine). The period in hospital and the number of days during which the faeces remained positive were reduced by half in the sulphaguanidine-treated cases, as compared with those receiving no chemotherapy, except in the case of Sonne convalescent carriers, where there was no significant difference. The treatment with sulphanilamide produced no more beneficial effect than sodium sulphate. —J. M. Robson.

Gilbert, F. W. (1943). **Preliminary Report on Pentamidine in the Treatment of Late Cases of Sleeping Sickness.**—*Trans. R. Soc. trop. Med. Hyg.* **36.** 353–358. **895**

A report is given on the treatment of 14 cases of *T. gambiense* infection with pentamidine either intramuscularly in doses of 1·6–5·15 mg. per kg. body weight daily for eight days, or intravenously in doses of 1·5–3·3 mg. per kg. In old cases of sleeping sickness, pentamidine reduced the cell count of the cerebrospinal fluid and improved the clinical condition, but in advanced cases verging on coma, no benefit appeared to be conferred. It is considered that intravenous injection is better than intramuscular administration, and that doses of at least 2 mg. per kg. body weight should be given. The follow-up of cases has not been long enough to judge whether the drug gives permanent benefit.—U. F. Richardson.

Stoddard, E. D. (1943). **Sulfanilamide Therapy in a Case of Eimeria canis.**—*Vet. Med.* **38.** 276. **896**

It is claimed that sulphanilamide, administered at the rate of 20 grains per day to a 10 lb. cocker spaniel effectively suppressed the oocyst production of *E. canis*, and that the general condition of the dog improved. The diagnosis of coccidiosis was made by floating oocysts from a sample of faeces. [The note does not indicate the method used in identifying the parasite as *E. canis*. It is possible that all the oocysts would have been discharged in any case over the period named in the absence of treatment, if the dog had not been exposed to reinfection.]—C. Horton Smith.

Greve, W. (1943). Vergleichende Chemotherapie und Prophylaxe der Caballi-Babesiose bei Heerespferden in Sowjet-Russland. **[Control and Treatment of Babesiasis in Army Horses in Soviet Russia].**—*Z. Veterinärk.* **55.** 117–136. **897**

Babesia caballi infection is probably the most serious disease of horses in Western Russia. The disease occurs in the spring and autumn, the infection being confined to certain known pasture lands; the vector is thought to be the tick *Dermacentor silvarum*. The disease is characterized by fever which may pass unnoticed for several days, as loss of appetite and weakness appear at the earliest 24 hours after the onset of fever, and may be delayed several days. Jaundice is not a constant symptom and its appearance is often delayed, whilst petechial haemorrhages on the mucous membranes have only been observed in a few animals and haemoglobinuria has not occurred. Acaprin, trypan blue, and trypaflavine were satisfactory in treatment provided that they were used in the early stages of fever, but when treatment was delayed until clinical symptoms developed, the mortality reached 30%. It is important to recognize the early stage of the disease, but in only 12% of such cases could the organisms be detected in blood smears. It is recommended that diagnosis for purposes of treatment should be based on the history of the outbreak, the febrile reaction, and the reputation of the district. Relapses commonly occur after treatment, usually in 4–15 days, and it is recommended that treatment be repeated 3–4 days after the first dosing, as a matter of routine. It appears that immunity is not as lasting as is supposed, and that on recovery the organisms are eliminated from the body relatively quickly. Cases were noted of animals which recovered without treatment from attacks in the spring, but contracted infection again in the autumn, whilst the local Russian horses do not seem to retain immunity as a result of attacks contracted as foals.

The prophylactic value of trypan blue and trypaflavine, given a few days after the start of the piroplasmosis season, was confirmed, but G. does not accept the contention that the spring disease is more severe than the autumn form, and considers that prophylactic injections should be given at both seasons in endemic areas.—U. F. Richardson.

Kapur, H. R. (1943). **Chemotherapy of Canine Piroplasmosis due to *Babesia gibsoni*.**—*Indian vet. J.* **19.** 199–205. **898**

In an outbreak of *B. gibsoni* infection in kennels in Bihar, 27 dogs were treated with novarsenobillon, sulfarsenol, or tryparsamide. Novarsenobillon, in doses of 0·01 g. per lb. body weight, gave best results; ten out of 11 cases treated with this drug recovered completely. Sulfarsenol in doses of 0·1 g. per lb. body weight was less effective, five out of 11 treated cases recovering. Tryparsamide was used in doses of 1·0 g. for medium sized dogs; only one out of five dogs so treated recovered. A course of four injections was given in the case of each drug. [Details of the blood examination are not given.]—H. N. Ray.

Hurst, H. (1943). **Principles of Insecticidal Bio-Assay.**—*Nature, Lond.* **152.** 400–404. **899**

Chemical assay is not a reliable index of toxicity of an insecticide because each constituent may contribute to gross toxicity. Also, the biological activity of an insecticide may vary according to the mode of application used.

In the present article, an attempt is made to analyse some of the main factors which influence dosage

and biological activity relations in systems in which insecticides are brought into contact with insects under controlled conditions. The fundamental variables in an insecticidal test system may be resolved into (1) the test insect, (2) the insecticide, and (3) the mode of application of the insecticide to the test insect.

These considerations are illustrated by some selected examples in which insecticides were applied to insects in systems which represent the limits of the range of conditions under which insecticides are generally used in practice.—W. MOORE.

BRUCE, W. G. (1942). **Acidified Nicotine Sprays for Horn Flies on Cattle.**—*J. Kans. ent. Soc.* **15.** 120–123. **900**

When lactic or acetic acid was incorporated in nicotine sprays, a great increase was obtained in toxicity against horn flies (*Lyperosia irritans*). The presence of acetic acid, however, made the spray objectionable because of its disagreeable odour. The most effective spray contained 0·5% nicotine and 1·0% lactic acid. The addition of 2% formalin to a nicotine solution prevented deterioration due to the growth of bacteria and moulds.—W. MOORE.

DAVID, W. A. L. (1943). **Delousing of Clothing by Fumigation.**—*Brit. med. J.* July 24th. 108. **901**

In the small-scale disinfestation of clothing, any air-tight box may be used. The garments to be fumigated are placed one by one in the box, and a little of the fumigant sprinkled on each. When the box is filled, the lid is closed and allowed to remain for the prescribed time.

The fumigants recommended are methyl formate, ethyl formate, and methyl-allyl chloride. Of these, methyl formate is quickest in action, cheapest, and most easily available. It is suggested that a two-hours' exposure at 20°C. to 22 c.c. of methyl formate per cu. ft. gives the most economical results.—W. MOORE.

MOSCI, A. (1943). Os banhos carrapaticidas e sua importancia em higiene veterinária. **[Importance of Dipping for the Control of Ticks].**—*Bol. Soc. brasil. Med. vet.* **12.** 31–40. **902**

M. stresses the necessity of dipping cattle in Brazil for the control of ticks, especially of *Boophilus microplus*, which is the common transmitter of piroplasms. Practical advice is given on the quality of water to be used, tests for hardness, the preparation of arsenical solutions, tests for strength of solutions, and the care necessary to prevent undue concentration or dilution. He considers that the dipping tank sponsored by the Brazilian Government is too short.—MILLER WATSON.

I. ARTEMICHEV, M. (1943). Gazookurivanie shei i golovy loshadi. **[Gas Fumigation for the Treatment of Equine Mange of the Head and Neck].**—*Veterinariya, Moscow.* No. 2. p. 26. **903**

II. —. (1943). Gazokamery dlya okurivaniya loshadeĭ sernistym angidridom. **[Gas Chamber for Fumigation of Horses with Sulphur Dioxide].**—*Ibid.* pp. 37–39. **904**

III. ZUBKOV, A. P., CHIZHEVSKIĬ, I. I., & ZOTOV, V. I. (1943). Portativnyĭ pribor "VL-413" dlya opredeleniya sernistovo angidrida v gazokamerakh. **[Portable Apparatus for Determination of Sulphur Dioxide in a Gas Chamber].**—*Ibid.* pp. 41–42. **905**

IV. SEMENOV. (1943). Obrabotka shei loshadi sernistym angidridom. **[Method for Treatment of the Horse's Neck with Sulphur Dioxide].**—*Ibid.* pp. 43–44. **906**

I. The author recommends a slight modification in the gas fumigation chamber, which would allow exposure of the whole neck and part of the head to the action of the SO_2 gas. This is achieved by the fixing in the cell of a bar which prevents the animal from approaching the front wall, and by the elongation and the alteration of the shape of a bag which is fastened around the brow and nasal bones. A. believes that this modification will simplify the treatment of horse mange. There is an illustration.

II. Various recommendations are given for the economic construction, under conditions of emergency, of gas chambers and accessories for the fumigation of horses in order to control mange and lice. The paper is accompanied by useful drawings.

III. SO_2 from the gas cell is collected in a gas absorber containing iodine solution, which is decolorized on reduction by the SO_2, a quantitative reading being obtainable.

IV. S. describes a modification of the gas chamber consisting of an elongated canvas neck tube which is fastened on the nape of the neck and the nasal bones. S. claims this modification to be reliable, safe, and economical.—A. MOLDAWSKY.

POLYAKOV, A. A. (1943). Dezinfektsiya predmetov konskovo ukhoda i snaryazheniya. **[Disinfection of Stable Equipment].**—*Veterinariya, Moscow.* No. 2. pp. 33–37. **907**

Various methods are discussed of disinfecting stable equipment under field conditions. Sulphur dioxide and formaldehyde fumigation are described in detail. Sulphur dioxide in 4–5 vol. % is regarded as adequate for the control of mange and lice.—A. M.

I. PIZZI, L. (1943). Eficacia de la fenotiacina en el enteque de los bovinos. **[Phenothiazine in the Treatment of Bovine Helminthiasis].**—*Bol. tec. Direcc. gen. Agric. Ganad., B. Aires.* Secc. ganad. No. 8. pp. 481–484. **908**

II. QUEVEDO, J. M., CANO, A. E., & MATA, E. G. (1943). Experiencias con fenotiazina (bovinos y ovinos). **[Tests of Phenothiazine in Cattle and Sheep].**—*Rev. Med. vet., B. Aires.* **24.** 151–166. **909**

I. An account of the successful use, in the usual doses, of phenothiazine in bovine helminthiasis in the Argentine.

II. An account of the use of phenothiazine in cattle and sheep.—MILLER WATSON.

NEKRASOVA, M. A. (1941). Farmakologicheskaya kharakteristika karbokholina (dorila pri lentina). **[The Pharmacology of Lentin].**—*Veterinariya, Moscow.* No. 3. pp. 119–124. [French summary]. **910**

This is a report on laboratory and a few clinical experiments on "Carbocholin" (lentin) prepared in the U.S.S.R. The results obtained were similar to those obtained by many other authors who used lentin [*m*-phenylene-diamine hydrochloride].

—A. MOLDAWSKY.

HERMAN, C. M. (1942). **The Effect of Higueronia on Nematodes and Nemathelmintic Gastric Ulcers of California Sea Lions.**—*Rev. med. trop. parasit., Habana.* **8.** 45–47. [In English]. **911**

Higueronia [a proprietary preparation of the sap or latex of trees of the genus *Ficus*, preserved with sodium benzoate], was tested as an anthelmintic against the stomach worms (subfamily *Anisakinae*) of sea lions, but it proved to be ineffective. Crude latex preserved by refrigeration was, however, effective; on the fifth day after dosage the egg count was reduced to one-tenth of the count before dosage. Ficin, the active principle of the latex, proved to be too violent in its action to be useful as an anthelmintic, although it was effective against the stomach worms. Refrigerated latex and higueronia were administered at the rate of 2·5 ml. per "5 g." [? misprint for kg.] body weight to dogs heavily infected with *Trichuris*. The higueronia

produced little noticeable effect on the egg count, whilst the refrigerated latex produced a marked reduction; this confirms the findings of other workers.
—T. E. GIBSON.

ANDERSON, G. W., & MUSSELMAN, L. (1942). **The Treatment of Tetany in Pregnancy with a Brief Review of the Literature.**—*Amer. J. Obstet. Gynec.* **43.** 547–567. **912**

The clinical and biochemical features of hypoparathyroid tetany in pregnant women and its diagnosis and treatment are the main topics of this article. The literature is reviewed (except for recent European reports which were not available) and a few references are made to experimental hypoparathyroid tetany in the pregnant dog and rat. 240 cases of tetany in pregnant women are tabulated from reports by various authors and classified into four types, *viz*, (1) post-operative hypoparathyroid tetany (26 cases), (2) idiopathic (spontaneous) tetany (145 cases), (3) tetany of dietary origin, due to low Ca intake or vitamin D deficiency (9 cases), and (4) tetany associated with thyroid disease. The authors' observations on three cases of tetany of type I are reported and attention is drawn to some of the altered clinical features of parathyroid insufficiency in pregnancy. The occurrence of pregnancy may precipitate tetany and thereby unmask a state of chronic hypoparathyroidism. In general, the symptoms are intensified in pregnant women and dogs but not, apparently, in pregnant cats.

Various other conditions are mentioned in which symptoms of muscle spasms and convulsions are presented, since these conditions have to be borne in mind when a diagnosis of chronic hypoparathyroidism is made. Blood chemistry studies are invaluable and some workers include radiographic and kidney function tests as further aids to differential diagnosis. Formerly, the occurrence of tetany in pregnancy was accompanied by high foetal and maternal mortality, but now, chronic hypoparathyroidism can be successfully treated by carefully regulated oral and intravenous administration of Ca preparations and dihydrotachysterol (AT 10), combined with reduction in the P content of the diet. Concurrent toxaemias must, however, be watched for in cases of tetany with pregnancy. AT 10 has a very great advantage over parathormone since no tolerance is developed to this drug and, furthermore, it is cheap and can be administered orally. The dose of AT 10, which varies with the patient, can be assessed and controlled by serum Ca determinations and Sulkowitch tests for urine Ca. Overdosage must be avoided but the dangers are minimal.—W. R. MUIR.

MCINTOSH, J., & SELBIE, F. R. (1943). **Chemotherapeutic Drugs in Anaerobic Infections of Wounds.**—*Lancet.* **244.** 793–795. **913**

A reliable technique is described for testing the comparative value of chemotherapeutic substances on anaerobic infections in mice. The organisms are washed to remove toxin and suspended in 2·5% calcium chloride; 100 lethal doses are injected into the thigh. The drug to be tested is injected an hour later at the same site as the infecting injection. The most effective substances against the individual infections were penicillin against *Clostridium welchii* and *Cl. oedematiens*, and sulphathiazole against *Cl. septicum*. The acridines possess a fairly powerful action against all three anaerobes, although in a lower degree. Propamidine had a lower activity against all three organisms, though its individual action in the cases of *Cl. welchii* and *Cl. oedematiens* compared favourably with the sulphonamides.

It is suggested that the best prophylactic results may be obtained by the local application of a mixture of sulphathiazole and proflavine; the use of vehicles should be confined to superficial application. Treatment in the more advanced stages of the disease is difficult and requires additional measures and the use of antitoxins.—J. M. ROBSON.

BUTLER, E. C. B. (1943). **Propamidine in Surgical Infections. A Clinical Study.**—*Lancet.* **245.** 73–75. **914**

The results in ten cases treated with propamidine jelly or solution are reported. Seven of ten cases illustrate the value of propamidine in the treatment of recent war wounds, infected hands, and certain types of bone infection. The jelly should not be used if the wound is to be sutured; the skin around open wounds should be protected by soft paraffin. The wounds rarely became sterile while under treatment, but their rate of healing seemed to be hastened.—J. M. ROBSON.

PARFENTJEV, A., GOODLINE, M. A., & CLAPP, F. L. (1943). **Preparation and Properties of a Dry Powdered Mixture of Sulfanilamide and Hemostatic Globulin.**—*J. Lab. clin. Med.* **28.** 1465–1467. [Authors' summary copied *verbatim*]. **915**

1. Evidence is presented that dry hemostatic globulin possesses remarkable stability at high temperatures, withstanding eight hours' heating at 110°C. at the end of which period it shows very little loss of its thrombic activity.

2. The mixture of hemostatic globulin and sulfanilamide may be of value in the treatment of wounds, since it possesses both thrombic and bacteriostatic properties.

See also absts. **766** (treatment of *T. mutans* and *B. bigemina* infection), **850** (— for dehydration), **883** (— for serum sickness), **816** (phenothiazine in sheep).

HYGIENE AND PUBLIC HEALTH

—. (1943). **Great Britain. Measures to Improve the Quality of the Nation's Milk Supply. [Govt. White Paper.] Cmd. 6454.** pp. 8. London: H.M. Stat. Off. [8vo] [2d.] **916**

No milk would be sold in areas scheduled by the Ministry of Agriculture unless it is either (1) heat treated, (2) from a tuberculin tested herd, or (3) from an accredited herd and is sold by a retailer who sells only the milk from a single accredited herd.

The Ministry of Agriculture are to administer measures relating to the production of milk and would ensure that milk of good quality reaches the consumer. Their policy includes the improvement of breeding animals, greater efficiency and frequency of inspection of dairy herds, and an increase in the supply of T.T. milk. It is recognized that the basis of any long-term scheme must be the adoption of a progressive breeding policy; the present bull licensing scheme has to some extent lost effect through indiscriminate cross breeding.

A system of inspection of all herds in the country is proposed, but is not immediately practicable owing to the limited number of inspectors at present available. For the present, T.T. and attested herds would be inspected every six months and accredited herds every year if the milk is pasteurized, or every three months if it is not pasteurized. Other (non-designated) herds would be inspected annually when the milk is pasteurized or twice a year, within the limits of the staff available, when the milk is not pasteurized. Later the number of inspections of non-designated herds would be increased

involving about 30,000 additional nspections for the country as a whole, and special attention would be paid to these herds and to those with a bad disease history. Attention would also be paid to buildings and equipment on farms in order to raise the standard of hygiene and to ensure uniformity; the administration of legislation dealing with this aspect would be transferred from the local authorities to the Ministry of Agriculture.

In order to encourage the production of T.T. milk, the premium would be raised from 2½d. to 4d. per gallon. This would be paid to the producer and the Government would be responsible for marketing the milk. The price to the public would be little greater than that of non-designated (pasteurized) milk. Schools would be supplied as far as possible from T.T., pasteurized, or accredited milk from single herds.

Heat-treated milk must satisfy the requirements of the phosphatase test; it must pass a methylene blue test for cleanliness.

The scheme would be enforced by areas. Plans are outlined to provide the small producer-retailer with facilities for pasteurization and local authorities would install pasteurizing plants if necessary.

In Scotland, where the standards of milk production are higher, and in Northern Ireland, modified schemes would be introduced.—R. M. Arnold.

Rowland, S. J., Aschaffenburg, R., & Veinoglou, B. C. (1943). **Mastitis and the Freezing-point of Milk.**—*Analyst.* **68.** 302–303. **917**

The freezing-point depression (Δ) of milk samples from individual quarters of 133 milking cows was determined. The results obtained in 39 animals with subclinical mastitis in one or more quarters were compared with those from the remaining normal cows. There was no appreciably greater Δ-variability in quarter samples in either of the two groups and maximum Δ-values were not necessarily associated with the affected quarter. Δ was markedly increased in a few clinical mastitis cases where the secretion was visibly abnormal.

It is concluded that an abnormally high Δ in milk with a low solids-not-fat content indicates added water irrespective of whether the low level of solids-not-fat is due to mastitis or not.—D. N. Spriggs.

See also abst. **921** (food inspection).

TECHNIQUE AND APPARATUS

Knox, R., Gell, P. G. H., & Pollock, M. R. (1943). **The Selective Action of Tetrathionate in Bacteriological Media. A Report to the Medical Research Council.**—*J. Hyg., Camb.* **43.** 147–158. **918**

From a biological and chemical investigation of the constituents of Muller's tetrathionate broth, for the isolation of salmonella, the authors conclude that, of the active substances in the medium, tetrathionate is probably the most important. The results of their observations are illustrated by graphs and tables.

In suitable concentrations (0·03M) tetrathionate is a selective inhibitor of those faecal organisms which commonly obscure the bacteriological picture; on the other hand, in lower concentrations it behaves as a growth promoter for those organisms able to reduce it. The rationale of this dual action is discussed and its practical application suggested.—J. M. Peters.

Sasano, K. T., & Medlar, E. M. (1943). **Egg-Yolk-Potato Medium. Its Efficiency for Demonstrating Small Numbers of Tubercle Bacilli.**—*Amer. Rev. Tuberc.* **48.** 297–303. [Spanish summary]. **919**

Various egg media are discussed, the advantages of egg-yolk media being emphasized. Egg-yolk potato medium was compared with whole-egg medium and g. pig inoculation in the demonstration of tubercle bacilli in large numbers of smear-negative concentrates of sputum and gastric contents from tuberculous patients. The efficiency of egg-yolk potato medium approximated so closely to that of g. pig inoculation that the authors recommend its use in place of the latter in routine diagnosis. G. pig inoculation, however, is slightly more reliable than the cultural method. It should be used where pathogenicity tests are required. Where the number of organisms is small, visible growth averages one week less than on other egg media.
—R. M. Loosmore.

Slavin, G. (1943). **Brilliant Green—Neutral Red—Lactose Agar for the Isolation of *S. suipestifer* from Pig Faeces.**—*J. comp. Path.* **53.** 315–322. **920**

A comparison was made of the value of various media for the isolation of salmonella strains from artificially infected pig faeces. Kauffmann's tetrathionate brilliant-green bile enrichment medium was not used, owing to the difficulty of obtaining the dye specified by him. The results obtained were greatly in favour of the brilliant green, neutral red lactose agar used. The preparation of the medium, the characters of the growth of salmonella species, and the common contaminants, are described. By direct plating on this medium, 23 out of 28 salmonella strains, mostly *S. suipestifer* [*S. cholerae-suis*], were recovered. By plating on Endo and MacConkey agar, two strains only were recovered. By inoculation of a brilliant green telluric acid enrichment broth, with plating-out at the end of 24 and 48 hours, no strain was recovered.

S. states, however, that the direct method is not likely to be better than a good enrichment method in examining naturally infected faeces, in which salmonellas may be present in small numbers.—E. Cotchin.

Delay, P. D. (1943). **Contact Plates and Army Inspection of Food Plants.**—*Army vet. Bull., Wash.* **37.** 46–52. **921**

"Contact plates" consisting of a strip of metal on which a disc of nutrient agar is mounted have been applied on differently shaped surfaces for the purpose of making bacteriological cultures of food and the utensils which come in contact with it. A table is given showing the wide range of application and the counts which may be encountered under various conditions.
—J. M. Peters.

Marshall, S. (1943). **Composite Ziehl-Gram Staining Method for Sputum, Pus, and Exudates.**—*Brit. med. J.* Aug. 21st. 232–233. **922**

A description of a combined Gram and Ziehl-Neelsen method for staining films, used at the Brompton Chest Hospital. The reagents used are:– (a) Carbol fuchsin, as for Ziehl-Neelsen staining. (b) Picric acid decolorizer: saturated picric acid in ethyl alcohol, 5 parts, acetone 1 part; keep in a well stoppered bottle or staining jar. (c) Crystal violet: 0·25% aqueous solution. (d) Gram's iodine. (e) Acetone. (f) Auramine green counterstain: prepare 1% solutions of auramine and China green in distilled water, shake occasionally for 24 hours, mix the two solutions and filter if necessary; the stain keeps for several months if occasionally filtered.

Method of staining: Flood with (a) and heat almost to boiling, leave for 5 min. or longer. Wash in water. Decolorize with (b), the time required varying with the thickness of the film, usually 2–3 min. Wash

well. Treat with (d) for 1 min. Decolorize with (e) and at once wash rapidly. Counterstain with (f) for not longer than 15–30 sec. Wash, blot, and dry.

Tubercle bacilli are stained crimson and may show black beading. Gram-positive organisms are violet-black and Gram-negative organisms are grass green. The background is light green and cells are stained varying shades of blue-green or yellow-green. Degenerated Gram-positive organisms are the same colour as Gram-negative ones. The auramine green counterstain is also useful for ordinary Gram staining as it is very restful to the eye; cellular details are, however, less clear than when methylene blue is used.—E. G. W.

EISENHART, C., & WILSON, P. W. (1943). **Statistical Methods and Control in Bacteriology.**—*Bact. Rev.* **7.** 57–137. **923**

The following statistical methods are described with special reference to bacteriological data:– (1) tests of agreement of observed distributions of bacterial counts with theoretical distributions based on the binomial distribution or Poisson series; (2) statistical control of bacterial plate counts by observation of the distribution of D^2; (3) estimation of bacterial concentrations from dilution data; (4) application of tests of significance based on the normal distribution; (5) the design of experiments with reference to the analysis of variance; (6) the calculation of regressions and correlation coefficients; (7) use of the χ^2 test for the determination of goodness of fit and of independence in contingency tables.—R. S. DE ROPP.

MUDD, S., POLEVITZKY, K., & ANDERSON, T. F. (1943). **Bacterial Morphology as Shown by the Electron Microscope. V. Treponema pallidum, T. macrodentium and T. microdentium.**—*J. Bact.* **46.** 15–24. [For previous parts, see *V. B.* **13.** 278]. **924**

It was shown that these treponemes, like the bacteria, are enclosed in a delicate cell wall or periplast. Multiplication is by transverse division, the daughter cells being united by the cell wall until division is complete. After division the cell wall may extend as a terminal filament, but no true axial filament was observed.

Flagella, often in groups of four, were often seen along the sides or near the ends of the cells of *T. pallidum* and *T. macrodentium* and dense granules 40–90 mμ in diameter were observed within the protoplasm.

Irregularly spheroidal, dense bodies, 150–500 mμ in diameter were often found attached to the spirochaetal cell, frequently near the end; these bodies were sometimes in close apposition to the spirochetal cell, at others connected to it by a short stalk. These spheroidal bodies recall the conidia and chlamydospores of higher fungi; they are not artefacts, impurities from the medium, or products of degeneration. It is considered most probable that they are asexual reproductive bodies.—J. FRANCIS.

PATTON, R. L., & METCALF, R. L. (1943). **The Demonstration of the Protozoan Parasite of Quail Malaria by Fluorescence Microscopy.**—*Science.* **98.** 184. **925**

Plasmodium vivax, *P. nucleophilum*, and *Haemoproteus* can all be satisfactorily stained with fluorescent dyes. The authors report on tests with *Haemoproteus*. Positive staining reactions were observed with six fluorochrome stains which were applied as saturated aqueous solutions for 2–5 min. to smears fixed in methyl alcohol. Good contrasts were obtained, but the highest staining intensities were obtained with berberine sulphate, 2-ethoxy-6, 9-diamino acridine lactate (Rivanol), and primulin yellow. Alteration of the pH of the staining medium by means of phosphate buffers gave a very slight increase in staining intensity in the alkaline region. The apparatus required for fluorescence tests of this type is simple, the principal requisite being a G.E. type H-4 high pressure mercury vapour lamp as the source of light and a Corning filter No. 5840 which transmits light between the wavelengths of 310 mμ and 394 mμ. The advantages of the method lie in its simplicity, reliability, and rapidity in emphasizing the parasites, which stand out brilliantly against a dark field, and in the reduction of eye strain. The method has great possibilities for the study of antimalarial drugs and their action upon the parasites, as well as in the diagnosis of malaria from blood smears.
—C. HORTON SMITH.

NEFF & KERNREUTER. (1942). Erfahrungen mit dem Feldröntgengerät bei einer Veterinärkompanie im Bewegungskrieg. **[Experiences with a Mobile Field X-Ray Outfit in a Veterinary Company].**—*Z. Veterinärk.* **54.** 173–187. **926**

The authors relate their experience with a mobile X-ray outfit on the Russian front. The apparatus was a 75 kilovolt "Coolinaxos" machine consisting of the discharge tube suitably mounted on a wheeled frame, a collapsible dark room with developing equipment and an electric current generator driven by a petrol engine.

The outfit was evidently adequate for use on the limbs, but not the body, of horses and the available current was 55–75 kv. of 20 milliamps. It was easily transported in special containers and the whole of it could be unpacked and brought into operation in 20 min.

Some instances of its value in the diagnosis and graphic illustration of limb wounds are given.—J. E.

TREFOGLI, C. A. (1942). Las impregnaciones argénticas de Río Hortega en histología e histopatología nerviosa. **[Hortega's Silver Impregnation Method in Histology of Nervous Tissue].**—*J. agron. vet., Univ. B. Aires, 1941.* pp. 37–47. **927**

T. describes the methods for fixation and cutting of material, the preparation of reagents, and the various techniques for staining nerve cells and the associated connective tissue elements.—ISOBEL W. BURTON.

ARROYO, V. M. (1938). Inyecciones repletivas de sistemas arteriales. **[Method of Injecting Arterial Systems for Anatomical Demonstrations].**—*An. Fac. Med. vet., Univ. La Plata.* **1.** 207–210. **928**

Anatomical specimens for demonstration of arterial networks were obtained by injecting the arteries with solutions of celluloid in acetone and then allowing the surrounding soft parts to be dissolved by microbial action. The resulting preparations showed the arteries standing out rigidly in their true positions.
—ISOBEL W. BURTON.

HUTCHISON, H. E. (1943). **A Method of Producing Experimental Granulating Wounds.**—*Lancet.* **245.** 75–76. **929**

An operative procedure is described for making experimental granulating wounds in rats, g. pigs, and rabbits. The skin is removed from an area of the back a short distance behind the ears, the superficial muscle is split longitudinally and the underlying paired muscles are separated. A "Viskap" (a type of plastic cap commonly used as an occlusive seal on bottles) is then inserted and the skin and muscle drawn tightly round its neck. The "Viskap" rapidly becomes fixed to the margins of the wound by serous exudate. When the wound has reached the desired age, the "Viskap" is packed with moist cotton-wool which softens it so that at the end of half-an-hour it can be withdrawn leaving a moist undamaged granulation tissue lining round a cup-shaped wound.—D. D. OGILVIE.

See also absts. **729** (TB. diagnosis), **747-749** (brucellosis diagnosis), **758** (complement-fixation tests for Chagas' disease).

MISCELLANEOUS

I. Vlasov, N. M. (1943). Etapy stroitel'stva veterinarnovo dela v Krasnoĭ Armii. **[The Development of the Veterinary Service of the Red Army].**—*Veterinariya, Moscow.* No. 2. pp. 7–12. **930**

II. Petukhovskiĭ, A. (1943). Voenno-veterinarnaya akademiya Krasnoĭ Armii. **[The Military Veterinary Academy of the Red Army].**—*Ibid.* pp. 13–14. **931**

I. During the Revolution, at the beginning of the formation of the Red Army, there was a great shortage of both veterinarians and veterinary equipment. Repeated mobilization of veterinary officers during 1918–19 was insufficient to supply the need. It was therefore decided to militarize all existing veterinary institutes and colleges, which, during the Revolution, had become disorganized, and to place them under Red Army administration. At this period, the veterinary affairs of the country were administered by the Central Veterinary War Department with veterinary departments at the provincial commissariats for military affairs.

In 1921, at the end of the Revolution, both the military and civil veterinary services were temporarily administered by the Soviet Ministry of Agriculture, in order to unify the control and eradication of epizootics which had attained large dimensions in the country.

During the five-year plans, especial care was taken to improve the standards of veterinary hygiene in the army and of the education of veterinary officers. For this latter purpose, a military faculty was created at the Kazan Veterinary Institute, which later became the Veterinary Academy of the Red Army. Various research institutes, and various schools for veterinary assistants (*feldsher*) were also created.

In 1935, the veterinary statutes of the Red Army and legislation concerning army veterinary services were published.

At the beginning of the present war, the Red Army was well supplied with veterinarians and veterinary supplies and after 18 months of war, the whole organization was working smoothly. It is stated that 90% of hospitalized horses were returned to army service. A great deal of research work has been carried out on various questions in field hospitals.

II. The foundation of a military veterinary academy had been planned by the Tsarist government, but the first practical steps were not taken until 1925 when the Soviet government founded a military faculty at the Kazan Veterinary Institute; after a few years the faculty was reorganized, enlarged, and transferred to the Moscow Veterinary Institute. In 1935, it became a separate unit—the Military Veterinary Institute, and in 1938 it became the Military Veterinary Academy attached to the Red Army. The main aims of the Academy were the training of highly qualified veterinary officers and the re-education of army and reserve veterinarians. The Academy staff played an important role in the veterinary affairs of the U.S.S.R. They not only collaborated in drawing up the veterinary regulations and legislation of the Red Army, but also influenced many other matters such as veterinary education in general, control of various epizootics, and hygienic control of animal products. In peacetime, the Academy organized expeditions, lectures, and consulting services to the army. In the present war, many members of the Academy have been called to leading veterinary posts with the Red Army. There is also a liaison between the Academy and the front.

To celebrate the 25th anniversary of the Red Army, the Academy is issuing a special publication.—A. M.

Joyce, F. de V. (1943). **Notes on Agriculture in Ethiopia. Parts I–III.**—*E. Afr. agric. J.* **8.** 176–181 & 227–230, and **9.** 35–38. **932**

In 1941, J. made a rapid tour of 5,000 miles in many of the provinces and districts of Ethiopia and these papers detail the recommendations which he made regarding the development of the country's livestock, forests, and agriculture. The work is dealt with under the following headings :– natural features; livestock; food crops; plantation crops; soil conservation; communications, transport, and power; agricultural industries; general.

The area of Ethiopia is about 400,000 sq. miles with a population of about 8 million. It is one of the best watered countries in Africa. There are many rivers and streams as well as innumerable springs. Where there is no surface water, it is obtained from shallow wells. Even on the borders of French Somaliland, water is found 20–40 ft. below the surface. Good grasses are plentiful in most parts and the grazing available appears to be ample. There are 22 kinds of clover.

Cattle are of the humped type and are of poor quality. Their numbers are insufficient to maintain soil fertility and dairy produce is practically unobtainable. Little interest is taken in cattle except near a good meat market such as Addis Ababa, where the bullocks are in better condition, presumably due to supplementary feeding. The proportion of females in most of the herds examined was very small. The only large herds seen were in Wollo; at the edge of the Arussi country; near Jimma, and, to a lesser extent, in Gojjam.

Beef "measles" is very prevalent. The army condemnation rate at Addis Ababa was 15% and at Jimma 4%. Prevalent cattle diseases are stated to be :– rinderpest, bovine contagious pleuro-pneumonia, anthrax, blackleg, anaplasmosis, and redwater. J. thinks there is no East Coast fever, but gives no confirmatory evidence of this. Cattle are said to be remarkably free from ticks. Trypanosomiasis occurs in some areas (the Omo and Gojjeb valleys, the Sudan slope, and possibly elsewhere).

J. fears the danger of overstocking as the result of an energetic veterinary policy and therefore advises against any attempt to control animal diseases by a government veterinary service. He considers that private veterinary practitioners should be encouraged and government dairy farms should be established. Diseases of sheep are not discussed. There are very few goats. Camels were seen on the Somali slope, in Donakil and around Macalle. Horses, mules and donkeys abound everywhere and are likely to be the main means of transport for an indefinite period in many districts. African horsesickness, epizootic lymphangitis, and tick fever all occur.

A few pigs were seen and these were in good condition. Poultry are widely distributed, but they are of poor quality.—J. A. Griffiths.

Panisset, M. (1943). **Veterinary Notes on "Our Second Front".**—*J. Amer. vet. med. Ass.* **102.** 83–88. **933**

A short description of livestock production, animal diseases, and the veterinary organization in French Morocco. Reference is made to the important part played by veterinarians in the early colonization of that country. The important animal diseases are mentioned.
—N. J. Scorgie.

Smith, H. R. (1943). **Sheep and Surgical Sutures.**—*Iowa Vet.* **14.** No. 1. 16–18. **934**

Owing to the reduction in the importation of sheep casings (intestines) from Australia, there is a shortage

of "catgut" sutures in the U.S.A. Approximately 25% of all U.S. sheep casings are unusable for surgical sutures, because of damage from nodular worms. The use of phenothiazine for the control of the infestation is advocated, and it is anticipated that the general adoption of routine treatment with the drug will result in a considerable improvement in the position.

—D. D. OGILVIE.

REPORTS

GREAT BRITAIN. (1943). **Ministry of Agriculture and Fisheries. Agricultural Improvement Council for England and Wales. First Report (Covering the period to 30th June, 1942).** pp. 18. London: H.M. Stat. Off. [8vo] [3d.] **935**

The report is divided into two parts, part I dealing with the problems of how new knowledge should be incorporated into farming practice. The Council stress the important part which the Agricultural Advisory Service plays in this respect by keeping abreast of progress and conveying the discoveries of research workers to the farming community in the appropriate way and at the right time. They emphasize the necessity for an economic stability to enable farming to progress, for the incorporation of new methods must generally involve additional expenditure which otherwise could not be sustained and would not be countenanced. It is vital that these should be tried out under practical conditions before they are recommended to the industry as a whole and, in this connexion, the co-operation of established farmers of good repute is invaluable.

In part 2, the Council make recommendations relating to the organization and dissemination of knowledge concerning certain specific aspects of agriculture such as machinery, ley farming, hill sheep farming, soil surveys, artificial insemination, etc.

Though the policy of the Council must inevitably be long term in nature, they appreciate the necessity for taking early action where possible in order to improve and co-ordinate knowledge and to assist the dissemination of knowledge already available.

—N. S. BARRON.

U.S.A. (1939). **Annual Report of the International Health Division, The Rockefeller Foundation, 1938.** pp. 233. New York: The Rockefeller Foundation. [8vo]. **936**

U.S.A. (1940). **Annual Report of the International Health Division, The Rockefeller Foundation, 1939.** pp. 230. New York: The Rockefeller Foundation. [8vo]. **937**

U.S.A. (1941). **Annual Report of the International Health Division, The Rockefeller Foundation, 1940.** pp. 247. New York: The Rockefeller Foundation. [8vo]. **938**

U.S.A. (1942). **Annual Report of the International Health Division, The Rockefeller Foundation, 1941.** pp. 224. New York: The Rockefeller Foundation. [8vo]. **939**

U.S.A. (1943). **Annual Report of the International Health Division, The Rockefeller Foundation, 1942.** pp. x + 194. New York: The Rockefeller Foundation. [8vo]. **940**

These reports give accounts of the work carried out under the auspices of the International Health Division of the Rockefeller Foundation, with details of the monetary grants made to finance the operations in various countries.

About 140 International Health Division Fellows were working in about 30 countries in the years prior to the present war.

2½–3 million dollars were spent each year prior to the war on the operations of the International Health Division, the work being spread all over the world.

Of comparative veterinary interest in these issues is work on human influenza (technique, strains, immunization, serology); the epidemiology, immunology, and diagnosis of rabies; psittacosis-like viruses associated with atypical pneumonia in human beings, and centrifugation of viruses; tuberculosis (vaccination); worm infestation (dogs); Rocky Mountain spotted fever and sylvatic plague (presence of infection in wild animals and birds); malaria in animals and birds. The reports contain a great deal of information concerning research, both of a fundamental and of an applied nature, relating to a wide variety of disease subjects.

See also abst. **821** (cancer campaign report).

BOOK REVIEWS

HAGAN, W. A. [D.V.M., D.Sc., Professor of Bacteriology and Dean of the Faculty New York State Veterinary College, Cornell University]. (1943). **The Infectious Diseases of Domestic Animals with special reference to Etiology, Diagnosis, and Biologic Therapy.** pp. xxvii+665. 145 figs. Ithaca, N.Y.: Comstock Publishing Co. [8vo] [$6.00]. **941**

This book is intended for students of veterinary medicine, both graduate and undergraduate, but the author assumes that the reader has a knowledge of the general principles of the subject. The following sentence is quoted from the preface:– "Since students of animal diseases are interested in micro-organisms more because of what they do than for what they are, the work is not a systematic discussion of disease producing organisms, but rather a discussion of the infectious diseases of animals with special reference to their etiological factors". It follows that the work must not be regarded as a text book on veterinary bacteriology, and this being borne in mind, it will be welcomed as a long overdue contribution to the subject of infectious disease.

The book is divided into six parts:– I, "The Mechanisms of Infection and Resistance"; II, "The Pathogenic Bacteria"; III, "Bacteria-like Pathogenic Organisms of Uncertain Classification"; IV, "The Pathogenic Fungi"; V, "The Pathogenic Protozoa"; VI, "The Viruses".

A certain number of references are given after each subject. These are not intended to be complete but are given so that those who wish to read more exhaustively will find them useful as a key to the literature. The subject matter is attractively set out and it is accompanied by numerous clear illustrations which are unambiguous, a quality sadly lacking in many similar works.

For nearly all diseases, the information and references are well up-to-date. A few errors, however, may be detected. Thus, on p. 52 it is suggested that normal agglutinins are the result of mild inapparent infections; no mention is made of agglutinins which could not have arisen from experience of the organisms concerned, such as agglutinins for *Pfeifferella mallei* in equine sera in Great Britain, agglutinins for *Vibrio cholerae* in g. pig

sera, etc. Again, on p. 87, in discussing *Streptococcus agalactiae*, H. completely misinterprets the work of MINETT, STABLEFORTH and EDWARDS. These workers did not divide *Str. agalactiae* into types I, II, and III. They grouped mastitis streptococci into three groups, one of which, group I, was *Str. agalactiae*. It is also incorrectly stated that *Str. agalactiae*, *Str. dysgalactiae*, and *Str. uberis* all fall into Lancefield's group B, since only *Str. agalactiae* (Minett's group I) belongs to group B. Also, in a description of *Corynebacterium pyogenes* no mention is made of its capacity to produce toxin.

Despite these errors, H. has rendered a service by providing veterinary workers with a modern and authoritative book, which can be recommended to all those who need a reliable work of reference on infectious diseases in animals.—D. L. HUGHES.

—. (1943). **Banham's Veterinary Posology and other Information for the use of Students and Practitioners.** [Revised by IRONSIDE, W. J. (M.P.S., M.R.C.V.S.)]. pp. vii + 206. London: Baillière, Tindall & Cox. [7th Edit.] [8vo] [12s. 6d.] **942**

The first impression received when this edition is compared with the previous one is that the contents have been very drastically reduced, although the price has been increased by 50%; on more careful perusal, however, it may be seen that the reduction in pages has been achieved to a large extent by the use of smaller type and by a more economical arrangement of the contents. A notable example of this rearrangement is the table of solubilities which occupies only five pages as against 45 in the former edition, although in the present edition more information is given.

The section on dangerous drugs regulations is a very desirable addition to the book. Diseases due to filtrable viruses are now included, and the table dealing with parasites has been brought up to date in a most commendable manner.

It is unfortunate that doses are given for the horse, pig, and dog only, no indication being given for regulating the doses of the various drugs for cattle, sheep, cats, poultry, etc. The sixth edition contained a supplement recommending the doses for young animals of the various species, comparative doses by special channels, and the doses per lb. body weight for dogs. Although it is admittedly impossible to lay down rigid rules with regard to these matters, nevertheless a general indication should have been given with suitable notes in the tables with regard to particular drugs. Such notes would have served a much more useful purpose than the inclusion in the posological tables of preparations which are merely enumerated and to the strength of which no reference is made, which was surely the only reason for their inclusion in the sixth edition.

The posological tables contain, as one would wish, the names of drugs which are used only on comparatively rare occasions, but it is regretted that there are some notable omissions. This is especially noticeable with regard to the various vitamin preparations, both synthetic and natural.

The table of anatomical weights, etc., is of doubtful use and in any case needs revision. Meat inspectors are not likely to agree that the weight of an average bullock's heart is only 3½ lb.

The table of official and veterinary formulae has been entirely recast and is now noteworthy for the fact that although it occupies 15 pages, no veterinary formula is given at all, but merely formulae copied from the British Pharmacopoeia and British Pharmaceutical Codex. Had these official formulae been left out of the book, it is very doubtful indeed if the book would have suffered in any degree.

Suggested therapeutics have been considerably revised, but it is noteworthy that there is no reference to poultry diseases.

Certain tables have apparently been copied from the sixth edition without any attempt to bring them up to date or to check the veracity of the statements contained therein, as for instance, in the tables dealing with utero-gestation and the number of females allowable to each male. Surely something more modern than Fleming's "Veterinary Obstetrics" of 1878 could have been quoted.

The table giving the percentage of alcohol in the various beverages is of doubtful use, and, in any case, is based on pre-war standards which are more likely to be of historical than practical value. Practically all the Orders mentioned on page 173 have been replaced by more recent enactments. The book is an invaluable work of reference for veterinarians.—H. E. BYWATER.

FREAR, D. E. H. [Ph.D., Assistant Professor of Agricultural and Biological Chemistry, the Pennsylvania State College]. (1943). **Chemistry of Insecticides and Fungicides.** pp. viii + 300. 31 figs. New York: D. Van Nostrand Company, Inc. [2nd Printing] [8vo] [$4.00]. **943**

This book, concerned as it is with the composition, properties, and reactions of many substances used to control insects and plant diseases, is primarily designed for the use of workers in the fields of economic entomology, plant pathology, and horticulture. A short introduction is followed by 14 chapters arranged under the following five headings:– "Stomach Poisons (Protective Insecticides)", "Contact Poisons (Eradicant Insecticides)", "Fungicides, Spray Supplements and Residue Removal", and "Macro- and Micro- Analytical Methods". Each chapter is followed by a relatively extensive bibliography and there are comprehensive author and subject indexes.—J. LOCHIEL MCGIRR.

WEST, E. S. [Ph.D., Professor of Biochemistry in the University of Oregon Medical School]. (1942). **Physical Chemistry for Students of Biochemistry and Medicine.** pp. xiv + 368. 24 figs. New York: The Macmillan Co. [8vo] [$5.75]. **944**

That a reasonable knowledge of certain fundamental aspects of physical chemistry is of importance for an understanding of biochemistry and the biological sciences generally, and, therefore, that this science has considerable significance for medical and veterinary students is a well established fact. On the other hand, it appears to be rather a moot question whether individuals in these two categories, with their present well filled curricula, have time to give more than a cursory glance at the subject of physical chemistry. Nevertheless, the contents of this book, written in a simple, lucid, and relatively non-mathematical fashion and dealing with those important physico-chemical relationships upon knowledge of which must rest an understanding of fundamental biological phenomena, will well repay study by any medical or veterinary student.

The ten chapters of the book, the second of which is particularly well written, are headed as follows:– "Introduction"; "The Structure of Matter and Some Fundamental Chemical Principles"; "Gases and Solutions"; "Osmotic Pressure"; "Electrolytic Dissociation and the Mass Law"; "Acids, Bases, and Buffers"; "The Determination of pH"; "The Colloid State and Membrane Phenomena"; "Oxidation and Reduction"; and "The Velocity of Reactions". Each chapter is followed by a set of problems and exercises and by a selected bibliography; there is a short appendix dealing with the use of logarithms, followed by both author and subject indexes.

—J. LOCHIEL MCGIR

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